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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior



VOLUME 9, NUMBER 12 JUNE 15, 1976

W76-05501 -- W76-06150

he Secretary of the U.S. Department of the Interior has de-≇mined that the publication of this periodical is necessary in the ≇ansaction of the public business required by law of this Depart-

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978. As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Research and Technology U.S. Department of the Interior Washington, DC 20240

CONTENTS

UBJEC	T FIELDS AND GROUPS
	Please use the edge index on the back cover to locate Subject Fields and Indexes.
01	NATURE OF WATER Includes the following Groups: Properties; Aqueous Solutions and Suspensions
02	WATER CYCLE Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.
03	WATER SUPPLY AUGMENTATION AND CONSERVATION Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water o Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.
04	WATER QUANTITY MANAGEMENT AND CONTROL Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.
05	WATER QUALITY MANAGEMENT AND PROTECTION Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.
06	WATER RESOURCES PLANNING Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives Ecologic Impact of Water Development.
07	RESOURCES DATA Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.
08	ENGINEERING WORKS Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.
09	MANPOWER, GRANTS, AND FACILITIES Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.
10	SCIENTIFIC AND TECHNICAL INFORMATION Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.
SU	BJECT INDEX
AU	THOR INDEX
OF	GANIZATIONAL INDEX
۸٥	CESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

NATURE AND STABILITY OF COMPLEX MERCURY COMPOUNDS IN SURFACE AND GROUND WATERS, PHASE II, Auburn Univ., Ala. Dept. of Chemistry. For primary bibliographic entry see Field 5A. W76-05838

2. WATER CYCLE

2A. General

QUURM - A REALISTIC URBAN RUNOFF

MODEL, Queen's Univ., Kingston (Ontario). W. E. Watt, and C. H. R. Kidd. Journal of Hydrology, Vol. 27, No. 3/4, p 225-235, December, 1975. 3 fig, 2 tab, 10 ref.

Descriptors: *Hydrographs, *Storm runoff, *Model studies, Urban runoff, Sewers, Rainfallrunoff relationships, Computers, Simulation analysis, *Computer models, Computer programs.

In order to develop better techniques for the pre-diction of urban storm runoff, the Queen's University urban runoff model (QUURM) was developed and tested for application at the existing or planning level. The principal criterion in the selection of the model was its ability to simulate observed flows with a minimum number of flow parameters and reasonable costs for computer and data collecting time. The model consists of two parts. The first part is the total catchment made up of hydrographs taken from four subcatchments The subcatchments were an impervious front such as a paved street, a pervious front such as a front lawn, a pervious and impervious back such as a back roof and back lawn, and a non-contributing area such as an area lower than the adjacent inlet to the storm-sewer system. The second part of the model combined the hydrographs and routed them through the sewer pipe network to the outlet. The infiltration rate was determined by employing Horton's equation for infiltration capacity. QUURM's simulation results, taken from 10 rainfalls during two summers, were then compared with three other models' results taken from the same rainfalls. QUURM's results compared favorably, and a detailed comparison of QUURM and the EPA model is presented in tables and graphs. The advantages of QUURM are that it is a parameters. (Loustau-FIRL)
W76-05577

DEVELOPMENT AND FIELD TESTING OF A

BASIN HYDROLOGY SIMULATOR, Texas Univ. at Austin. Dept. of Petroleum En-

gineering. R. M. Knapp, D. W. Green, E. C. Pogge, and C. Stanford.

Water Resources Research, Vol. 11, No. 6, p 879-888, December 1975. 11 fig, 1 tab, 17 ref. OWRT A-055-KAN(1).

Descriptors: *Hydrologic systems, Hydrology, *Simulation analysis, *Mathematical models, *Surface-groundwater relationships, Groundwater Surface-groundwater relationships, robundwater movement, Streamflow, Soil types, Hydrologic cycle, Soil moisture, Soil water movement, Groundwater recharge, *Computer models, Geohydrologic units, Watersheds(Basins), Groundwater recharge, "Computer models, Geohydrologic units, Watersheds(Basins), "Hydrographs, "Kansas. Identifiers: "Groundwater levels, Hydrologic simulation, "Little Arkansas River(Kan), Upper soil zone, Lower soil zone.

A computer model consisting of both surface water and groundwater phases and their interaction has been developed to simulate the hydrology of a stream basin. Input to the model includes precipitation, climatic conditions, boundary and initial conditions, and basin constants. Provision has been made for modeling withdrawals from both groundwater and surface water for consumptive use. The computer output includes streamflow hydrographs at selected points, groundwater levels, and groundwater recharge and discharge from the basin. The model was designed to be general in nature so that it will be applicable to different basins with similar geographic and geological conditions. Its structure is such that the basin is divided vertically into four layers and a stream network. The four vertical layers are, in order from top to bottom, a surface layer, an upper soil zone, a lower soil zone, and a groundwater layer (aquifer). Provision was also made to subdivide each layer horizontally into blocks, or sub-basins, which are determined by considering topography, soil types, and climatic data. The model was described in detail, and its application to the Little Arkansas River basin of south central Kansas was made. A 25-year period of history in this basin was simulated, and comparisons were made between calculated behavior and measured hydrologic behavior in the basin. (Terstriep-ISWS)

EVALUATION OF DATA AVAILABILITY AND EXAMPLES OF MODELING FOR GROUND-WATER MANAGEMENT ON CAPE COD. MAS-SACHUSETTS,

Geological Survey, Boston, Mass. For primary bibliographic entry see Field 4B.

DEPENDABLE YIELD OF RESERVOIRS WITH INTERMITTENT INFLOWS.

Agricultural Research Service, Stillwater, Okla. Water Conservation Structures Lab For primary bibliographic entry see Field 4A

COMMENT UPON MULTIVARIATE SYNTHETIC HYDROLOGY.

Centro di Ricerca IBM di Pisa (Italy) G. Finzi, E. Todini, and J. R. Wallis. Water Resources Research, Vol. 11, No. 6, p 844-850, December 1975. 4 fig, 9 tab, 10 ref.

Descriptors: *Synthetic hydrology, *Streamflow, *Markov processes, *Stochastic processes, Storm runoff, Water resources development, Optimum development plans, Persistence, Computer programs, *Algorithms

Identifiers: Multisite, Multiseason, *Reservoir op-timization, *Matalas algorithm, Numerical multisite package, Generated sequences, Lag-one Markovian model.

A correction to Young and Pisano's numerical multisite package was proposed. It was believed necessary but insufficient to make the computer coding reproduce the desired Matalas algorithm for Markovian synthetic flows. In addition, it was believed that the sequences generated by even a corrected computer program may not always be adequate for reservoir optimization studies. Multisite multiseason synthetic hydrology can be a useful tool in the evaluation of proposed water reservoir systems. However, the simple lag one monthly Markovian model produces population statistics for which many of the observed statistics would have to be considered as rare events. In particular, if persistence (runs of high or low values), or the magnitude and probability of extreme events are important, then there are grounds to question the validity of using such a simple algorithm for the generation of synthetic sequences. (Morris - ISWS) W76-05909

USING PARAMETRIC MODELS OF RUNOFF TO IMPROVE PARAMETER ESTIMATES FOR STOCHASTIC MODELS,

Kentucky Univ., Lexington, Dept. of Agricultural

Engineering.
For primary bibliographic entry see Field 2E.

WIND EFFECTS ON STREAM FLOWS,

Delaware Univ., Newark. Coll. of Marine Studies; and Delaware Univ., Newark. Dept. of Civil Engineering. For primary bibliographic entry see Field 2E.

GEOLOGY AND WATER RESOURCES OF CHARLES MIX AND DOUGLAS COUNTIES, SOUTH DAKOTA, PART I: GEOLOGY, Geological Survey, Vermillion, S. D. For primary bibliographic entry see Field 4A.

HYDROLOGIC ASPECTS OF URBANIZATION, For primary bibliographic entry see Field 4C W76-05925

MAPS OF THE ELEMENTS OF THE HYDROLOGIC BUDGET OF ASIA,

Akademiya Nauk SSSR, Moscow. Institut Gregrafii.

G. M. Nikolayeva, and G. M. Chernogayeva Soviet Hydrology, Selected Papers, No. 2, p 126-132, 1974. 5 fig. 11 ref. Translated from News of the USSR Academy of Sciences, Geographic Se-ries (Isvestiya Akad. nauk SSSR, Ser. geograf.), No. 2, p 89-97, 1974.

Descriptors: *Asia, *Hydrologic budget, *Maps, Precipitation(Atmospheric), Evaporation, Groundwater, Streamflow, Runoff, Monsoons, Rainfall, Climatology, Mapping.

Maps were constructed on the basis of computations by a method based on a system of waterbalance equations where total river runoff is separated into its surface and underground components, and the total wetness of the area is defined as the difference between evaporation and surface runoff. To determine the input of the hydrologic budget, i.e., precipitation, a map of annual precipitation totals was used. Daily informa-tion on discharges published in hydrologic year-books, national runoff maps, and fragmentary published information were used to study total river runoff. These materials served as a basis in the construction of generalized maps of the elements of the hydrologic budget (total river runoff, its surface and underground components, evaporation, and total wetness), which can be used to analyze the distribution of these elements in Asia. (Sims - ISWS) W76-05934

2B. Precipitation

PRECIPITATION MANAGEMENT FOR RECLAMATION OF OVERGRAZED AREAS IN ARID AND SEMI-ARID REGIONS,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering. N. S. Grigg.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 166, \$3.50 in paper copy, \$2.25 in microfiche. Colorado Environmental Resources Center, Fort Collins, Completion Report, January 1976, 10 p. OWRT A-026-COLO(1). 31-1372-1603.

Descriptors: *Precipitation(Atmospheric), *Arid lands, *Revegetation, Mine wastes, Economics, *Environmental effects, *Strip mine wastes,

Group 2B-Precipitation

Feasibility studies. *Land reclamation, Manage-

An investigation was made of the feasibility of utilizing precipitation management as a method for the vegetative restoration of strip mine spoils in arid and semi-arid areas, and for the economic and environmental improvement of reclaimed mine spoils. The procedure is believed to be capable of producing vegetative systems of higher economic and wildlife habitat value than exists naturally on these same lands or might be produced by other non-irrigated methods. It would appear that the cost of the necessary R&D program would be minimal, particularly when compared with the potential economic, environmental and social benefits which would accrue.

ISOTOPIC STUDY OF HAIL,

Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires; and Commissariat a l'Energie Atomique, Saclay (France). Departement de Recherche et Analyse. J. Jouzel, L. Merlivat, and E. Roth.

Journal of Geophysical Research, Vol. 80, No. 36, p 5015-5030, December 20, 1975, 17 fig, 4 tab, 32 ref, 2 append.

Descriptors: *Hail, *Isotope studies, *Tritium, *Deuterium, Radioisotopes, Stable isotopes, Tracers, Thunderstorms, Precipitation(Atmospheric), Cloud physics, Ice, Water, Freezing, Meteorology. Identifiers: Hailstones

A detailed interpretation and discussion was presented of deuterium and tritium measurements carried out on six hailstones. The isotopic variations of condensed water in a hail cloud were studied on the basis of a cloud model proposed by A. J. Chisholm. The influence of the existence of a liquid water accumulation zone and of the presence of hailstones on isotopic profiles was also analyzed. The importance of tritium analysis was demo deuterium were defined. The interpretation and discussion of the experimental results were based mainly on the measurements made on three hailstones produced during a storm on August 7, 1971, in the province of Albastrated, and conditions of validity of the isotopic model proposed by L. Merlivat, G. Nief, and in the case oferta in Canada. It was demonstrated that the hailstones were formed during a succession of upward and downward movements, at least two of the latter occurring in the updraft core, and that the distribution of the updraft velocity with altitude was not stable during the storm, a finding which is in agreement with its multicellular nature. (Sims - ISWS) W76-05665

DESIGN AND RESULTS OF COMPARATIVE TESTS OF A RAINFALL RECORDER OPERAT-ING FOR A WEEK (WRR), For primary bibliographic entry see Field 7B.

W76-05674

FIELD OBSERVATIONS OF THE PER-SISTENCE OF AGI-NH4I-ACETONE ICE NUCLEI IN DAYLIGHT, Bureau of Reclamation, Miles City, Mont. Div. of

Atmospheric Water Resources Management. For primary bibliographic entry see Field 3B. W76-05677

TREND ANALYSIS OF ANNUAL INDIAN RAIN-FALL,

Institute of Tropical Meteorology, Poona (India). B. Parthasarathy, and O. N. Dhar. Hydrological Sciences Bulletin, Vol. 20, No. 2, p 257-260, June 1975. 1 fig, 1 tab, 6 ref. Descriptors: *Rainfall, Rain gages, *Time series analysis, Statistics, Monsoons, Wet seasons, Dry seasons.

Identifiers: *India, *Trend analysis, *Annual Indian rainfall. Mean annual rainfall. Standard devia-

The average annual rainfall of the Indian area (excluding the island territories in the Arabian Sea and the Bay of Bengal) was calculated for each year from 1901 to 1960 by using data from 3,000 ra-ingages distributed uniformly throughout the country. This time series of rainfall has been subjected to statistical analysis. It was found that the mean annual rainfall was of the order of 1190 mm with a standard deviation of 95 mm. The southwest monsoon season (June-September) rainfall contributed about 75% of the mean annual rainfall. The wettest year (1917) had a rainfall 22% in excess of the mean annual rainfall, and this was immediately followed by the driest year (1918) which was lower than the mean annual rainfall by about 19%. The mean values of the annual rainfalls for the 30-year period from 1931 to 1960 showed a significant increase of about 5%. (Roberts-ISWS) W76-05691

CONTINUOUS SEASONAL PROBABILITY OF EXTREME RAINFALL EVENTS,

Agricultural Research Service, Athens, Ga. Southeast Watershed Research Center. W: M. Snyder.

Hydrological Sciences Bulletin, Vol 20, No 2, p 275-283, June 1975. 6 fig, 2 tab, 7 ref.

Descriptors: *Probability, *Rainfall, *Seasonal, Distribution, Probable maximum precipitation, Least squares method, Stochastic processes. Identifiers: *Lognormal distribution, *Extreme rainfall events, Seasonal probability, Cyclic functions, Extreme daily rains.

The lognormal distribution was adapted to seasonally continuous distribution by making two of its three parameters cyclic functions of annual time. Distribution parameters were evaluated by treating 12 monthly distributions as a continuum of data. Simultaneous evaluation of all parameters was accomplished by nonlinear least squares. The extreme daily rainfall from each month of record was used. The method thus provided for 12-fold increase in utilization of recorded data over the conventional annual series. The derived distributions were used to generate stochastic future monthly sequences of extreme daily rains. (Roberts-ISWS) W76-05692

STATISTICS OF RAINGAGE DATA,

McGill Univ., Montreal (Quebec). Dept. of Physics. G. Drufuca, and I. I. Zawadzki. Journal of Applied Meteorology, Vol. 14, No. 8, p 1419-1429, December 1975. 15 fig, 6 tab, 5 ref.

Descriptors: *Rainfall *Rainfall disposition. *Rainfall intensity, Rates, Precipita-tion(Atmospheric), Rain, *Statistics, Probability, Data processing, Correlation analysis, Rain gages, Storms, Meteorology.

Ten years of raingage data were processed to obtain a statistical description of the precipitation process at the ground as function of time at a point and as function of space using the concept of 'synthetic storm'. Probability distributions of various parameters were given: mean rainfall rate, total amount, maximum rate, mean square rate, duration length, decorrelation time and distance. The joint distributions of mean rate, maximum rate and total amount were also determined. The probability distribution of rainfall rate was calculated and the effect of time smoothing of the data was studied. Some information about the spatial structure of the precipitation process was given as joint probability of rainfall rate at two points for

various separation distances and by the space autocorrelation function. (Sims - ISWS) W76-05693

ON RADAR-RAINGAGE COMPARISON, Quebec Univ., Montreal. Dept. of Physics.

I. I. Zawadzki.

Journal of Applied Meteorology, Vol. 14, No. 8, p 1430-1436, December 1975. 6 fig, 2 tab, 8 ref.

Descriptors: *Rainfall, *Radar, *Rain gages, Measurement, Analytical techniques, Data processing, Correlation analysis, Precipitation(Atmospheric), Meteorology.
Identifiers: *Radar-rainfall relationships, *Radar-

rainfall measurements, Integration times.

Spacial smoothing by the radar beam as well as post-detection integration reduce the variability of the distribution of rainfall rate in space. It was shown that when radar data are compared with instantaneous point rainfall rate a random error and a bias are introduced by the smoothing. This could account for some of the difficulties in the hydrological use of radars. It was shown that when raingage data are smoothed in time there is an optimum smoothing time interval such that the random error and the bias are reduced to a negligible level. A method was suggested for the optimum comparison of radar and raingage data, and the possibility of a determination of Z-R relationships from such comparisons was discussed. (Sims -W76-05694

DETACHMENT OF PENDANT WATER DROPS BY HIGH VOLTAGE PULSES,

State Univ. of New York, Albany. Dept. of Atmospheric Sciences

M. Nifuku, and B. Vonnegut.

Journal of Applied Meteorology, Vol. 14, No. 8, p 1617-1619, December 1975. 1 fig, 4 ref. ONR N00014-71-C-0156.

Descriptors: *Drops(Fluids), *Cloud physics, *Laboratory equipment, Electrical equipment, Laboratories, Equipment, Electricity, Research facilities, Research equipment, Meteorology. Identifiers: *High voltage pulses, Drop formation.

In the conduct of various laboratory experiments in cloud physics it is sometimes necessary to produce liquid droplets having a known size of the order of millimeters in diameter. An experimental arrangement was described in which drop detachment is produced electrostatically by the application of a high voltage pulse. It was shown that an isolated water drop of any desired size in the range 0.2 to 5.1 mm diameter can readily be formed on demand by using the method to detach a drop hanging from the end of a small tube. While all of the experiments were made with water. the same apparatus can also be used with other liquids if their electrical relaxation time is small compared to the pulse duration and if their viscosity is not too large. (Sims-ISWS) W76-05917

POSSIBILITY OF DETERMINING THE AREAS OF HEAVY PRECIPITATION BY DISCRETE REPRESENTATION OF RADAR DATA,

B. Sh. Divinskaya.

Soviet Hydrology, Selected Papers, No. 2, p 104-109, 1974. 3 tab, 5 ref. Translated from Transactions of the Main Geophysical Observatory (Trudy GGO), No. 309, p 15-22, 1974.

Descriptors: *Precipitation(Atmospheric), Pescriptors: "Precipitation(Atmospheric), 'Radar, "Rainfall, Data processing, Analytical techniques, Rainfall intensity, Storms, Thunderstorms, Meteorology, Estimating, Forecasting. Identifiers: "Shower areas, Rainfall patterns.

A method was proposed for estimating the total shower area from the number of echo cells with

Snow, Ice, and Frost—Group 2C

showers, determined by the observation method of the Main Geophysical Observatory. The proposed method was based on the conversion of the number of discrete shower echo cells to the number of showers and subsequently to the total shower area. This method made it possible to determine the echo area with a probable error of about 30%. The relation between the measurement errors and the number of cells with showers was determined, making it possible to estimate not only the area of the precipitation echo, but also the possible errors in per cent for each specific observation series. It was found that the shower echo areas vary within a relatively broad range, so that considerable errors appear in the determination of their total area. Therefore, the proposed method must be considered as a first approximation in the problem being solved. To reduce the errors, it was proposed to investigate in the future the possibility of introducing corrections by taking into account the intensity of shower echoes, which correlates with the shower areas. (Sims - 1SWS) W76-05933

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SURFACE ENERGY BUDGET OF SOME CLIMATIC REGIMES IN WEST AFRICA, Cape Coast Univ. (Ghana). Dept. of Physics. A. N. De-Heer-Amissah. Ghana J Sci. 13(2): 109-123. 1973.

Descriptors: *Africa, Rain forests, *Tropical regions, Wet climates, *Wet seasons, Forests, Soil moisture, Soil water, *Heat budget, Evapotranspiration.
Identifiers: *Savanna, West Africa.

The heat budget of the savanna and equatorial rain forest was studied. The energy balance terms are calculated from synoptic observations. Energy turn-over shows striking differences from station to station and from season to season. The seasonal variation is largest in the thick forest belt where the maximum occurs during the dry season. As a consequence, forest areas should exhibit more pronounced annual weather changes. This conclusion does seem to be a variance with what is observed in nature since atmospheric activity is more pronounced during the transition between wet and dry periods. Perhaps a truer picture would emerge if monthly turnovers over a period of years are compared. Radiation balance in both regions are positive throughout the year. In general soils with low water holding capacity have higher rates of evapotranspiration. Evapotranspiration is controlled not so much by soil water content by itself, but by soil water tension. Soil moisture as a limiting factor on evapotranspiration is very pronounced in the savanna belt.—Copyright 1975, Biological Abstracts, Inc.

CLIMATIC WATER BALANCE AT HISSAR, Haryana Agricultural Univ., Hissar (India). O. P. Bishnoi, and S. M. Virmani. Haryana Agric Univ J Res. 3(3): 131-134. 1973.

Descriptors: *Water balance, Asia, Evapotranspiration, *Climates, Water supply. Identifiers: *Hissar(India), Water deficit, Water surplus.

A study was undertaken to determine the principal elements of climatic water balance at Hissa (India). Potential evaportranspiration, water deficit and water surplus was determined on a weekly basis. The water deficiency was about 91 cm while the water surplus was 7.9 cm.—Copyright 1974, Biological Abstracts, Inc. W76-06041

EFFECTS OF A TROPICAL CYCLONE ON LITTORAL AND SUB-LITTORAL BIOTIC COMMUNITIES AND ON A POPULATION OF DUGONGS (DUGONG DUGON (MULLER)), James Cook Univ., of North Queensland, Townsville (Australia).

For primary bibliographic entry see Field 2L. W76-06131

2C. Snow, Ice, and Frost

ref, 6 append.

EVALUATION OF THE TROPHIC TYPES OF SEVERAL ALASKAN LAKES BY ASSESSMENT OF THE BENTHIC FAUNA,

Alaska Univ., College. Inst. of Water Resources. For primary bibliographic entry see Field 5C. W76-05604

LAKE AND SHORE ICE CONDITIONS ON SOUTHEASTERN LAKE MICHIGAN IN THE VICINITY OF THE DONALD C. COOK NUCLEAR PLANT: WINTER 1973-74, Michigan Univ., Ann Arbor. Great Lakes Research Div.

E. Seibel, C. T. Carlson, and J. W Maresca, Jr. Special Report No 55, 1975. 61 p, 13 fig, 2 tab, 15

Descriptors: *Lake Michigan, *Ice, Ice cover, Lake ice, Lake shores, Lakes, Shores, Nuclear powerplants, Winter, Photography, Winds, Deterioration, Wind velocity, Sediment load. Identifiers: *Shore ice, Donald C. Cook Nuclear Plant(Mich), Time lapse photography, Nearshore zone, Ice accretion, Wind direction, Ice ridges, Oblique photographs.

A time lapse photographic system designed to take oblique photographs of the nearshore zone at the Donald C. Cook Nuclear Plant in southeastern Lake Michigan was used to provide a nearly con tinuous record of ice conditions during the 1973-74 winter season. The ice conditions have been categorized into five distinct stages: no ice, static, accretion, deterioration, and breakup. These five stages of ice development were related to wind direction, wind speed, air temperature, and water temperature. A typical sequence of shore ice formation through breakup was established through qualitative analysis of the photographs. The typical sequence was influenced by the complex interrelationship between the climatic variables and ice stage development. Quantitative analysis of the photographs was used to test and subsequently verify the hypothesis that the nearshore ice ridges, offshore bars, and breaker zones are coincident in location at approximately 40 and 100 meters from the water's edge. The observations revealed that large quantities of sediment are incorporated into the nearshore ice and that the nearshore ice ridges ground themselves on the nearshore bottom to protect the shoreline from erosion from winter storms. (Roberts - ISWS) W76-05664

COLLAPSE OF THE HUDSON BAY ICE CENTER AND GLACIO-ISOSTATIC REPOIND.

Colorado Univ., Boulder. Inst. of Arctic and Alpine Research; and Colorado Univ., Boulder. Dept. of Geological Sciences.

J. T. Andrews, and W. R. Peltier.

Geology, Vol. 4 No. 2, 72, 75 NSF, GA. 43191, 2, 66.

Geology, Vol.4 No.2,p73-75 NSF GA-43191. 2 fig. 18 ref. Feb 1976.

Descriptors: *Ice, *Ice cover, Geology, *Geologic history, Model studies, Mathematical models, Geologic time, Quaternary period, History, Geophysics, Geomorphology, Glaciers, Glaciology, *Canada. Identifiers: *Hudson Bay(Canada), Paleogeology,

Identifiers: *Hudson Bay(Canada), Paleogeology, *Laurentide Ice Sheet, Ice shelves, Deglaciation, Geophysics models, Mantle.

An ice-unloading model for Hudson Bay consistent with the rebound history of the Ottawa Islands requires collapse of the central dome of the Laurentide Ice Sheet between 12,000 and 10,000 years ago. Hudson Bay was then filled by a shallow ice shelf with ice streaming into the bay

from ice centers located over Keewatin and Labrador. The observed rebound is fully consistent with a uniform mantle viscosity of 10 to the 22nd power poises. (Sims-ISWS) W76-05669

THE MOVEMENT OF MELTING ICE OVER ROUGH SURFACES, Bristol Univ. (England). H. H. Wills Physics Lab.

Bristol Univ. (England). H. H. Wills Physics Lab. B. D. Chadbourne, R. M. Cole, S. Tootill, and M. E. R. Walford. Journal of Glaciology, Vol. 14, No. 71, p 287-292, 1975. 2 fig. 1 tab, 16 ref.

Descriptors: *Ice, *Melting, *Movement, Laboratory tests, Surfaces, Physical properties, Glaciology. Identifiers: *Regelation, Bed-slip processes.

Laboratory experiments showed that pieces of melting ice about one centimeter across, moving under normal loads across roughened glass surfaces, travel much faster than regelation theory predicts. The discrepancy is as much as 40 times for the finest scale surfaces (prepared by grinding with carborundum particles of 60 micrometers mean diameter), and increases further if the load is reduced below three bars. On the other hand melting ice moves, under similar conditions, across rough porous glass surfaces at approximately the speed predicted by regelation theory. It was suggested that the reason is that melt water, produced by the dissipation of frictional energy, accumulates at the interface between ice and ground glass where it promotes sliding, but can easily drain away from a porous surface. Similar effects at the bed of a temperate glacier may cause the contribution of regelation to the bed-slip process to depend sensitively upon the melt-water regime. (Sims-ISWS) W76-05671

THE PERMITTIVITY AND ATTENUATION IN POLYCRYSTALLINE AND SINGLE-CRYSTAL ICE IH AT 30 AND 60 MHZ.

ICE IH AT 30 AND 60 MHZ,
Department of the Environment, Ottawa
(Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario).
Glaciology Div.
G. P. Johari, and P. A. Charette.

G. P. Jonan, and P. A. Charette. Journal of Glaciology, Vol. 14, No. 71, p 293-303, 1975. 3 fig, 1 tab, 23 ref.

Descriptors: *Ice, *Electrical properties, *Laboratory tests, Attenuation, Anisotropy, Crystals, Physical properties, Electrical studies, Electromagnetic waves, Remote sensing, Glaciers, Ice cover, Glaciology, Identifiers: Permittivity, Polarization, Radio-echo sounding

The relative permittivity, epsilon prime, and attenuation, alpha, in laboratory-grown, polycrystal-line and single-crystal ice Ih are reported at 35 and 60 MHz in the temperature range -25 C to -0.2 C. The epsilon prime and alpha at 35 MHz and -1 C are 3.208 plus or minus 0.010 and 6.2 plus or minus 0.1 dB/100 m, respectively. From a comparison between the respective epsilon prime and alpha of the polycrystalline and a single-crystal ice measured perpendicular to the c-axis, it was concluded that any anisotropy of polarization at these frequencies is so small as to be undetectable. Amongst several factors that may contribute to anisotropy in ice, electronic polarization contributes 0.0037 to the difference between the relative permittivity measured parallel and perpendicular to the c-axis at -1 C and at frequencies less than 500 THz. Experiments have shown that the plastic deformation resulting from a uniaxial compressive stress of up to 100 bar does not influence the relative permittivity and attenuation of ice at 35 and 60 MHz. (Sims-ISWS)

Group 2C-Snow, Ice, and Frost

BRITTLE FRACTURE OF ICE AT 77 K,

Department of the Environment, Ottawa (Ontario). Inland Waters Directorate; and Department of the Environment, Ottawa (Ontario). Glaciology Div.

V. R. Parameswaran, and S. J. Jones. Journal of Glaciology, Vol. 14, No. 71, p 305-315, 1975. 9 fig, 3 tab, 23 ref.

Descriptors: *Ice, *Physical properties, *Strength, Stress, Strain, Crystals, Temperature, Yield strength, Mechanical properties. Identifiers: Low temperatures, Fractures.

Laboratory-grown single crystals, both pure and HF-doped, and pure polycrystals of ice, as well as natural, columnar-grained ice from the River St. Lawrence, have been deformed in uniaxial compression at 77 K at strain-rates between 0.0001 and 0.001/s. Brittle fracture was observed, with stress-strain curves similar to those found for rocks at room temperature. The first cracks appeared at low stresses, about 0.3 MN/sq m, in agreement with theory, but the failure or fracture stress was high about 50 MN/sq m. The ratio of experimental to theoretical strength was 0.28. HF doping of the single crystals had no effect at this temperature. (Sims-ISWS)

INTERNAL REFLECTIONS IN POLAR ICE SHEETS.

Birmingham Univ. (England). Dept. of Physics. J. G. Paren, and G.de Q. Robin. Journal of Glaciology, Vol 14, No 71, p 251-259, 1975. I fig, 3 tab, 18 ref.

Descriptors: *Ice, *Radio waves, *Reflectance, Glaciers, *Polar regions, Ice cover, Radar, Electromagnetic waves, Electrical properties, Electrical studies, Anisotropy, Physical properties, Glaiology.

Identifiers: *Internal reflections, *Polar ice sheets, Loss tangents.

Internal reflections are due to changes in electrical admittance betwen adjacent depositional layers. Reflection coefficients are given for discontinuous changes in either the permittivity or loss tangent. The observed strengths of internal echoes rule the possibility that they are caused by isolated layers containing 'foreign' material, but suggest instead that they are due to systematic fluctuations of density, anisotropy, or loss tangent. The electri-cal behavior of ice from polar ice sheets was reviewed and compared with that of ice grown in controlled laboratory conditions. It was suggested that the impurity distribution in polycrystalline ice is dependent on the impurity content and the tem-perature of freezing, and the conductivity is essen-tially determined by the intrinsic and impurity defects within the crystal lattice. In apolar ice sheet, density fluctuations decrease with depth, whereas loss tagents (and hence their fluctuations) increase since the ice becomes warmer towards bedrock. Echo strengths in central Antarctica were compared with those calculated for a boundary where either all bubbles disappear or the loss tagent changes by 50%. Assuming a constant layering geometry to 2,700 m depth, density fluctuations account for echoes above 1,500 m, but deeper echoes are best explained by variations in the ice conductivity. (Sims -ISWS)

EQUILIBRIUM-LINE ALTITUDES, MASS BALANCE, AND JULY FREEZING-LEVEL HEIGHTS IN THE CANADIAN HIGH ARCTIC, Massachusetts Univ., Amherst. Dept. of Geology and Geography.

Journal of Glaciology, Vol. 14, No 71, p 267-274, 1975. 4 fig, 1 tab, 15 ref.

Descriptors: *Glaciers, *Arctic, *Canada, Freezing, Ablation, Temperature, Snow, Ice, Glaciolo-

Identifiers: *Equilibrium-line altitudes, Freezinglevel heights, Mass balance, Glacier growth.

Equilibrium-line altitudes on the White Glacier, Axel Heiberg Island, and the north-west sector of the Devon Ice Cap were shown to be closely related to mean July freezing-level heights at nearby upper-air weather stations. An inverse relationship between July freezing-level heights and mass balance on the Devon Ice Cap was also shown. Reasons for such correlations were suggested and some limitations of the relationship were outlined. Recent lowering of the freezing level in July was discussed in relation to the theoretical 'steady-state' equilibrium-line altitudes in the Canadian high Arctic. It was suggested that positive mass-balance years have predominated over a large part of northern Ellesmere Island and north-central Axel Heiberg Island since 1963, and some glaciological evidence supporting this hypothesis was given. (Sims - ISWS)

SUBLIMATION OR MELTING: OBSERVA-TIONS FROM THE WHITE MOUNTAINS, CALIFORNIA AND NEVADA, U.S.A.,

Lethbridge Univ. (Alberta). Dept. of Geography. C. B. Beaty. Journal of Glaciology, Vol 14, No 71, p 275-286, 1975. 6 fig, 2 tab, 29 ref.

Descriptors: *Snow, *Mountains, *Sublimation, *Evaporation, Ablation, Snowpacks, Snow cover, Melting, Runoff, Snowmelt, Melt water, Water yield, Radiation, Solar radiation, Temperature, California, Nevada. Identifiers: *White Mountains(Nev and Calif).

Study of the waning snow-pack along the crest of the White Mountains of California and Nevada in 1970 and 1974 indicated that a significant proportion of the high-altitude snow in the range sublimates and/or evaporates shortly after melting. Qualitative and limited quantitative evidence suggested that the amount of snow thus disposed of may be as much as 50-80% of the total springtime pack. Meteorological observations in the White Mountains demonstrated that atmosphere condition/evaporation is common in May and June, the main ablation period in the mountains. The geneneral lack of evidence of surficial erosion on slopes above 3,500 m, often supposed to be widespread and caused by so-called 'snow-melt' runoff, was therefore readily explained--there is little 'snow-melt' erosion simply because there is only limited snow-melt. (Sims - ISWS)

NUCLEATION CHARACTERISTICS OF STREAM WATER AND FRAZIL ICE NUCLEATION,

Alaska Univ., College. Geophysical Inst. T. E. Osterkamp, and R. E. Gilfilian. Water Resources Research, Vol. 11, No. 6, p 926-928, December 1975. 3 fig, 11 ref. NSF GA-30748

Descriptors: *Frazil ice, *Streams, *Nucleation, *Alaska, Freezing, Drops(Fluids), Cold regions, Water, Ice, Temperature, Water temperature, Open channels, Crystallization.

A drop-freezing experiment was used to study the nucleation characteristics of some natural water samples taken from a supercooled stream in interior Alaska. A histogram of drop-freezing events, the differential nucleus spectrum and the cumulative nucleus spectrum described the experimental results. The drops froze over a temperature range from -4.3 C to -13.9 C with an average nucleation temperature of -8.2 C + or -1.5 C. The results of these experiments were compared to observations made during periods of frazil ice production in the stream. It was concluded that the supercooling necessary for spontaneous heterogeneous nucleation of ice in a thin surface layer of stream water

would be about -4 C. Since the surface temperature of the supercooled stream was found to be 0 C + or -0.5 C, frazil ice crystals cannot be nucleated spontaneously in the surface layer of water. (Sims -ISWS)
W76-05695

SOME OBSERVATIONS ON THE BEHAVIOR OF THE LIQUID AND GAS PHASES IN TEMPERATE GLACIER ICE,

Washington Univ., Seattle. Geophysics Program. C. F. Raymond, and W. D. Harrison. Journal of Glaciology, Vol. 14, No. 71, p 213-233, 1975. 9 fig, 3 tab, 23 ref, 4 append. NSF GA-28554.

D

c

Descriptors: *Glaciers, *Ice, *Bubbles, Melt water, Air, Cores, Core drilling, Sampling, On-site investigations, Flow rates, Glaciology, *Washington.
Identifiers: *Blue Glacier(Wash).

Microscopic and textural observations were made on ice samples cored from Blue Glacier slightly below the equilibrium line to depths of 60 m. Observations were started within a few minutes after collection. Water was found in veins along threegrain intersections, in lenses on grain boundaries, and in irregular shapes. Gas was found in bubbles in the interior of crystals, in bubbles touching veins, and locally in veins. Vein sizes showed spread; average cross-sectional area was about 0.0007 sq mm with no discernible trend with texture or depth except within 7 m of the surface. Before the samples were examined, they could have experienced a complex relaxation which could have changed them significantly. As result it was not possible to determine the in situ size of veins, but an upper limit could be determined. Also it was not possible to predict intergranular water flux per unit area, but 0.1 m per annum represents an upper limit. In coarse-grained ice the water flux density is likely to be even smaller, because of a low density of veins and blocking by bubbles. This indicates that only a very small fraction of the melt-water production on a typical summer day can penetrate into the glacier on an intergranular scale except possibly near the surface. The existence of conduit-like features in several cores suggested that much melt water can nevertheless penetrate the ice locally without large-scale lateral movements along the glacier surface. The observed profile of ice temperature indicated that the intergranular water flux may be much smaller than the upper limit determined from the core samples. (Sims-ISWS) W76-05915

THE THERMAL REGIME OF TRAPRIDGE GLACIER AND ITS RELEVANCE TO GLACIER SURGING.

British Columbia Univ., Vancouver. Dept. of Geophysics.
G. T. Jarvis, and G. K. C. Clarke.

Journal of Glaciology, Vol. 14, No. 71, p 235-250, 1975. 7 fig, 3 tab, 39 ref.

Descriptors: *Glaciers, *Temperature, *Surges, *Canada, On-site investigations, Measurement, Boreholes, Movement, Mountains, Glaciology. Identifiers: *Trapridge Glacier(Yukon Terr), *Surging glaciers, Glacier surging, Glacier behavior, Ice temperatures.

A deep-ice temperature measurement program has been conducted on Trapridge Glacier, Yukon Teritory. Large regions of temperate ice were predicted at the base of the otherwise cold glacier. The glacier snout, frozen to bedrock, appeared to act as an ice dam allowing the build up of an ice reservoir in the upper regions. Thermal regulation of the surges of Trapridge Glacier was suggested and the relevance of basal temperatures in large surging glaciers was discussed. (Sims-ISWS) W76-03916

SNOW ACCUMULATION AND MELTING IN THE FOREST AND IN CLEAR-CUT AREAS IN THE CENTRAL URAL, Vsesoyuznyi Nauchno-Issledovatelskii Institut Lesovodstva i Mekhanizatsii Lesnogo Khozyaist-

va. Pushkino (USSR).

. A. Mel'chanov. Soviet Hydrology, Selected Papers, No. 5, p 466-472, 1973. 1 fig, 5 tab, 19 ref. Translated from Forestry (Lesovedeniye), No. 5, p 15-21, 1973.

Descriptors: *Snow, *Snowpacks, *Melting, Melt water, Snow surveys, Forests, Coniferous forests, Snowmelt, Snowfall, Water equivalent, Runoff, Runoff forecasting, Vegetation effects, Forest management, Clear-cutting. Identifiers: *USSR.

Investigations showed that snow accumulation in the forest depends on the composition, density and age of plantations, the density of the forest canopy, and climatic characteristics of a given region. Conferous plantations intercepted 9.7% of the amount of snow falling in the open. The water equivalents of snow were lower in very dense plantations than in thin plantations of the same composition. They were 6-19% higher in birch than in spruce plantations. At the mountain station winter precipitation amounted to 89% in young stands and 86% in a mature coniferous forest, compared to the water equivalent of snow in a narrow felling. At the foothill station, the water equivalents of snow were the same in the forest and fellings, according to 3 years of observation. By snow-melting time, the greatest snow depth was recorded in young stands, then in fellings, and the lowest in the forest. The felling of coniferous forests promotes rapid snow disappearance and a twofold increase in snow melting rate. The duration of snow melting is the same in fellings and young stands and amounts to 10-26 days in the foothills of the Ural and 23-30 days in the mountains. In coniferous forests the snow melts within 25-37 days in the foothills and 38-47 days in the mountains. The snow melting rate is 2-4 times lower in fellings on southern than northern slopes. (Sims-ISWS) W76-05929

EXPLOITATION OF THE WATERS OF SUB-PERMAFROST ARTESIAN BASINS For primary bibliographic entry see Field 3B.

PLANT DEVELOPMENT UNDER SNOW, Wisconsin Univ., Madison. Dept. of Agronomy. For primary bibliographic entry see Field 21.

2D. Evaporation and Transpiration

THE HYDROLOGIC POTENTIAL OF UNIT AREAS: A BASIS FOR MANAGING WATER RESOURCES,

Forest Service (USDA), Berkeley, Calif., Pacific Southwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D.

RELATION OF THE CONSUMPTIVE USE COEFFICIENT TO THE DESCRIPTION OF VEGETATION.

R. C. Culler, R. L. Hanson, and J. E. Jones. Water Resources Research, Vol 12, No 1, p 40-46, February 1976. 6 fig, 1 tab, 21 ref.

Descriptors: *Evapotranspiration, *Hydrologic budget, *Arid climates, *Arizona, Flood plains, Correlation analysis, *Vegetation, *Consumptive use, Transpiration, Analytical techniques, Aerial photography, Remote sensing, Equations. Identifiers: *Gila River flood plain(Ariz), Consumptive use coefficient.

Evapotranspiration from three reaches of the Gila River flood plain in Arizona was measured by the water budget during 1963-1971. Initially, the vegetation consisted of salt cedar and mesquite with densities of canopy ranging from 10 to 100%. The phreatophytes were removed in stages during 1967-1971. Perennial grass seed was applied but did not become established, and the postclearing regetation was primarily annuals. Comparison of the evapotranspiration data from various reaches and comparison of data from before and after clearing required the application of an empirical equation. A consumptive use coefficient related to the description of vegetation was applied to an existing potential evapotranspiration equation based on macroclimatic observations. Initially, the vegetation description consisted of plant identification and canopy dimensions obtained by use of black and white aerial photography and ground measurements. In 1967, remote sensing in the form color infrared aerial photography became available and densitometric interpretation was used to develop a spectral signature as the vegeta-tion descriptor. (Woodard-USGS) W76-05843

MAPS OF THE ELEMENTS OF THE HYDROLOGIC BUDGET OF ASIA, Akademiya Nauk SSSR, Moscow. Institut Gregrafii. For primary bibliographic entry see Field 2A. W76-05934

SURFACE ENERGY BUDGET OF SOME CLI-MATIC REGIMES IN WEST AFRICA, Cape Coast Univ. (Ghana). Dept. of Physics For primary bibliographic entry see Field 2B. W76-06006

ROLE OF PHENYLMERCURIC ACETATE ON STOMATAL REGULATION AND WATER LOSS IN PROSOPIS CINERARIA LINN, Jodhpur Univ. (India). Dept. of Botany For primary bibliographic entry see Field 5G. W76-06011

THE ANNUAL VARIATION IN YIELD OF PASTURES IN THE SEASONALLY DRY TROP-ICS OF QUEENSLAND,

Commonwealth Scientific and Industrial Research Organization, Townsville (Australia). Pastoral Research Lab. For primary bibliographic entry see Field 3F. W76-06016

RATIO BETWEEN EVAPOTRANSPIRATION FROM LYSIMETERS AND EVAPORATION FROM SMALL EVAPORIMETERS USING 2-AND 3- HOUR PERIODS OF MEASUREMENT, Department of Agriculture, Summerland (British Columbia) Research Station. J. C. Wilcox, and W. K. Sly.

Can J Plant Sci. 54(3): 559-564. 1974.

Descriptors: *Evapotranspiration, *Lysimeters, *Evaporation, Measurement, Instrumentation, *Evaporimeters, *Bromegrass, Regression analy-

Evaporation (E) was measured from 2 types of small evaporimeters, and potential evapotranspiration (PET) from lysimeters containing bromegrass (Bromus inermis Leyss). Under complete vegetative cover and with soil moisture content maintained within the range 100-60% available water capacity, evapotranspiration occurred at the potential rate. Records of E, PET and meteorological parameters were taken every 2 or 3 h from dawn to dusk and once overnight, and hourly means were determined. Second-degree polynomial regressions indicated a marked increase in PET/E as E increased. This was found by multiple regression to be due mainly to differential effects of radiation on E and PET. Such differential effects were attributed primarily to the effects of light on stomatal opening; hence on PET more than on E. No significant diurnal effects on E, PET or PET/E were found that could not be attributed to variations in radiation temperature. wind and dew point .-- Copyright 1975, Biological Abstracts, Inc. W76-06029

EFFECT OF DEPTH AND SALINITY OF GROUND WATER ON EVAPORATION AND SOIL SALINIZATION, Central Soil Salinity Research Inst., Karnal

D R Sharma and S S Prihar Indian J Agric Sci. 43(6): 582-586. 1973.

*Salinity, Groundwater. Descriptors: Evaporation, *Saline soils, Depth, Loam, *Water Identifiers: Depth, Evaporation, Ground, Salinity,

Salinization, Soil, Water,

In a controlled study with soil columns, the evaporation from a sandy-loam soil with water table at 50 cm or more was not influenced by an evaporation of 8.8-16 mm a day from a US Weather Bureau class-A open-pan evaporimeter. The maximal evaporation from soil Y(mm) was related with the depth of the water table, X(cm), by the equation X=149.2-150 log Y. The effect of ground-water salinities of EC electrical conductivity 8 and 16 mmhos/cm and ground water depths of 50, 75 and 100 cm on soil salinization during a 13-wk rainless summer period was also investigated. The effect of ground water salinity on the salinization of the top 40-cm soil layer was more pronounced with shallower water table than with deeper water table .-- Copyright 1975, Biological Abstracts, Inc. W76-06036

ATION CHARACTERISTICS OF FINE-TEXTURED TARAI SOILS VARIOUS EVAPORATION POTEN-EVAPORATION THREE UNDER TIALS,

Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Soil

B. P. Ghildyal, and R. P. Tripathi. Indian J Agric Sci. 43(7): 704-707. 1973.

Descriptors: *Evaporation, Soils, Soil types, *Soil Identifiers: *India, *Tarai soils.

A laboratory study was conducted to compare the evaporation of water and distribution of salts under 3 evaporation potentials (daily evaporation from free water surface), 0.35, 1.2 and 1.6 cm/day, from initially saturated soil. Clay-loam, silty clayloam and loam soils of Pantnagar farm (India) were taken for the study. Cumulative evaporation increased with an increase in the evaporation potentials. The 1st stage of drying was solely dependent on the external evaporative conditions. The falling rate of evaporation indicates that the transmission properties of soils were the limiting factor of evaporation only after the 1st stage of drying. Though the first stage of drying was maintained for longer time at lower evaporation poten-tial (0.35 cm/day), the highest evaporation potential (1.6 cm/day) always resulted in maximum water loss and greater salt accumulation in the surface layers of the soils.-Copyright 1975, Biological Abstracts, Inc. W76-06037

CLIMATIC WATER BALANCE AT HISSAR, Haryana Agricultural Univ., Hissar (India). For primary bibliographic entry see Field 2B.

Group 2D-Evaporation and Transpiration

ECO-PHYSIOLOGICAL STUDIES ON DESERT PLANTS: IX. TYPES OF TRANSPIRATION CURVES OF ZILLA SPINOSA PRANTL UNDER NATURAL CONDITIONS

Cairo Univ., Giza (Egypt). Dept. of Botany. K. H. Batanouny. Flora (Jena). 163(1/2), p 1-6, 1974.

Descriptors: *Desert plants, *Plant physiology, *Transpiration, Arid climates, Moisture, Soils. Identifiers: *Zilla-Spinosa.

The daily march of the transpiration rate of Z. spinosa was studied under desert conditions in different months. The following types of transpira-tion curves were distinguished: dome-shaped curve obtained under mild climatic conditions and relatively considerable water supply; single-peaked curve, which is parallel to the evaporation curve. This was obtained under relatively good water supply and high evaporating power of the at-mosphere; single-peaked curve with an early maximum. This was observed under unfavorable climatic and edaphic conditions; and 2-peaked curve obtained under unfavorable climate and edaphic conditions. (See also W74-12743; W73-10364; W73-03116; W73-02093; W73-00176)--Copyright 1974, Biological Abstracts, Inc. W76-06123

2E. Streamflow and Runoff

LINE MOTION AND WATER CURRENT DISC SENSOR

Office of the Secretary (Navy), Washington, D. C. (Assignee).

For primary bibliographic entry see Field 7B. W76-05539

FLOOD ROUTING IN CHANNEL SYSTEMS WITH ALLOWANCE FOR BANK REGULA-

Latvian Scientific Research Inst. of Hydraulic Engineering and Reclamation, Jelgana (USSR). For primary bibliographic entry see Field 4A.

THE 1973 MISSISSIPPI RIVER BASIN FLOOD: COMPILATION AND ANALYSES OF METEOROLOGIC, STREAMFLOW, AND SEDI-MENT DATA.

National Weather Service, Silver Spring, Md.; and Geological Survey, Reston, Va. E. H. Chin, J. Skelton, and H. P. Guy.

Available from Supt. of Documents, GPO, Wash,

D.C. 20402, Price \$7.10. Geological Survey Professional Paper 937, 1975. 137 p, 74 fig, 9 plates, 12 tab. 32 ref

Descriptors: *Floods, *Mississippi River basin, *Hydrologic data, *Flood data, Streamflow, Sediment transport, Flood profiles, Meteorological data, Rainfall-runoff relationships, Gaging station, Flow measurement, Peak discharge, Sediment vield. Particle size. Sediment distribution Identifiers: *Mississippi River flood(1973).

The severe 1973 spring flood in the Mississippi River basin set new records for consecutive days above flood stage for most main-stem stations from southern Iowa to Louisiana. Peak stages and discharges far exceeding the estimated values for the 100-year flood occurred in April 1973 on many tributaries in Wisconsin, Iowa, Illinois, and Missouri. Described in this report are the meteorological setting of the flood, an account of the general characteristics of associated precipitation, and an analysis of a sample of significant precipitation events with return periods exceeding 100 years. The storm of April 19-21, 1973, with precipitation centered in northern Missouri, is analyzed as a case study. An estimation of evapotranspiration based on relevant meteorological factors indicates a probable reduction of such loss during the flood episode. Also included are summaries of stream stages, discharges, sediment data, and flood volumes for gaging stations where outstanding flood events occurred. The recurrence interval of the event is shown for many of the peaks and volumes. Flood-profile data for the main stem and selected tributary streams are included. (Woodard-USGS) W76-05860

CORRECTION OF BIAS IN THE ESTIMATION OF THE COEFFICIENT OF SKEWNESS,

Institut National de la Recherche Scientifique, Rimouski (Quebec). B. Bobee, and R. Robitaille.

Water Resources Research, Vol. 11, No. 6, p 851-854, December 1975. 2 fig, 4 tab, 2 ref.

Descriptors: *Probability, *Distribution, *Statistical methods, *Hydrologic data, Analytical techniques, Methodology, *Estimating. Identifiers: Coefficient of skewness, Method of moments, Pearson type 3 distribution, Weibull distribution, Population skewness, *Skew coeffi-

The mean, variance, and coefficient of skewness are generally used when a three-parameter dis-tribution is fitted by the method of moments. Because of the large sampling errors inherent in a skew coefficient calculated from small samples, a generalized or average skew coefficient is sometimes used in lieu of the value computed for a single site. The average of the skew values computed by the method of moments is a biased estimate of the population skewness. Results available so far indicate that the correction factor is a function not only of the sample size but also of the skew and the underlying distribution. A relation was developed between the population skewness and the average of the skew values computed by the method of moments in the case of Pearson type 3 distribution. For lognormal and Weibull distributions, these relations were different. Thus, the relation was shown to depend on the underlying distribution. (Singh - ISWS)

USING PARAMETRIC MODELS OF RUNOFF TO IMPROVE PARAMETER ESTIMATES FOR STOCHASTIC MODELS,

Kentucky Univ., Lexington. Dept. of Agricultural Engineering.

D. I. Carey, and C. T. Haan. Water Resources Research, Vol. 11, No. 6, p 874-878, December 1975. 2 tab, 9 ref.

Descriptors: *Synthetic hydrology, *Streamflow, Perametric hydrology, "Stochastic processes, Storm runoff, Water resources development, Model studies, "Estimating.

Identifiers: "Model parameter estimates, Extended the studies of the

sion of existing runoff records, Improving

The problem of evaluating and improving stochastic model parameter estimates was examined. A methodology was described for evaluating the ability of a parametric runoff model to improve short-record estimates of stochastic mode parameters by extension of existing runoff records. In an example, a particular parametric ru-noff model was studied. This parametric model was found to improve annual stochastic model parameter estimates significantly. The type of parametric model used in improving stochastic model parameters depends on the inputs required and the available data. A parametric model for which few inputs are needed is less restricted by lack of available data but will generally give results which are less accurate than those of a model which requires a great number of inputs. Owing to these limitations, there will exist runoff records of length beyond which historical data will give better estimates of stochastic model parameters than any extended record obtained from the parameters

model. Once the capabilities of a parametric model are determined to be sufficient for a given problem, it may serve as a powerful tool in reducing the uncertainty of stochastic model parameter estimates. (Morris-ISWS) W76-05911

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DISCHARGE EQUATIONS FOR HS, H, AND HL FLUMES.

Agricultural Research Service, Stillwater, Okla., Water Conservation Structures Lab. For primary bibliographic entry see Field 8B. W76-05918

WIND EFFECTS ON STREAM FLOWS,

Delaware Univ., Newark. Coll. of Marine Studies; and Delaware Univ., Newark. Dept. of Civil Engineering J. Wu.

Journal of Hydraulic Research, Vol. 13, No. 4, p 405-423, December 1975. 5 fig, 18 ref.

Descriptors: *Winds, *River flow, *Streamflow, Streams, Discharge(Water), Meanders, Velocity, Hydraulics, Open channel flow, Open channels, Sediment transport.

Identifiers: *Drift current, *Wind stress, Sediment-carrying capacity, Longitudinal wind, Wind resistance, Stream resistance, Meandering chan-nel, Centrifugal force, Velocity distribution, Cross

Wind is an unavoidable natural phenomenon; its effects on stream flows, however, have not been carefully evaluated. Wind blowing over the stream can be divided into two components: the longitudinal wind blowing along the stream and the crosswind blowing across the stream. Two specific effects were discussed: the effect of the longitudinal wind on the stream discharge and the effect of the crosswind on the river meandering. The influence of wind on the stream flow was presented in parametric form. A two-fold possible effect of the wind, wind stress and wind drift, was estimated. The lateral sediment transport carried out by the bottom current is the most vital link for initiation of river meandering. The distinctive feature of a meandering channel is the erosion of the outer bank and the deposition at the inner bank. The wind induces the erosion of the downwind bank and the deposition at the upwind bank. As the cross-section becomes more skewed, the transverse sediment transport intensifies. Once a fully skewed bed is established, the erosion and the deposition continue, even after the driving force no longer exists. Very different flow conditions, environmental and topographical, exist for various rivers. River meandering can be caused by one factor alone, or a combination of mechanisms. W76-05921

COMPARATIVE ESTIMATE OF ENERGY LOSSES IN BODIES OF WATER, AND QUIET AND TURBULENT FLOWS,

For primary bibliographic entry see Field 8B. W76-05924

SLOPE RUNOFF AND ITS CHANGE UNDER THE EFFECT OF AGRICULTURAL AND FOREST IMPROVEMENT PRACTICES, For primary bibliographic entry see Field 4C.

HYDRAULIC COMPUTATION OF A POOL HOLLOW, N. Ye. Kondrat'yev, and B. K. Trakhtenberg,

Soviet Hydrology, Selected Papers, No. 2, p 73-82, 1974. 6 fig, 6 ref. Translated from Transactions of the State Hydrologic Institute (Trudy Gossudarstvennogo Gidrologicheskogo Instituta), No. 216, p 5-18, 1974.

Descriptors: "Meanders, "Model studies, "Geomorphology, Banks, Streams, Rivers, Streamflow, Erosion, Sedimentation, Channels, Mathematical models, Flow, Velocity, Hydrau-Identifiers: *Pool hollows.

The first attempts to compute the formation of a pool hollow during free meandering were described. The pool problem is becoming of great practical importance because water intakes, pipeline joints, and other hydraulic structures are located in pools. Equally interesting is the new principle on which the computations are based. Unlike the usual solutions of hydrodynamic channel problems, in which the velocity field of a flow is determined within rigidly assigned boundaries, the boundaries themselves were determined in this case. The solution of the problem reduces to first analyzing a flow unconfined by banks. The velocity field of the flow is determined only by assigning the active forces. The noncorrespondence of such a 'free flow' with existing rigid boundaries leads to inconsistencies that produce channel deformations. The data used as a basis for the computations included numerous aerial photographs of the flood plains of meandering rivers. They made it possible to reconstruct the entire process of the horizontal reconstruction of meanders with time from the remaining traces of side bars. Pilot charts constructed at different times and other large-scale maps served as valuable additional material. These sources made it possible to develop an entirely reliable typical pattern of the horizontal developmet of meanders. (Sims -

WATER LEVEL GAUGE,

ISWS)

W76-05931

Department of the Navy, Washington, D.C. Office of the Secretary.
For primary bibliographic entry see Field 7B.

2F. Groundwater

HISTORY OF GROUND WATER CONCEPTS. National Water Well Association, Worthington, Ohio.

Water Well Journal, Vol. 30, No. 1, p. 26-27, January 1976.

Descriptors: *History, *Subsurface waters. *Groundwater movement, Groundwater recharge, Water sources, *Groundwater resources.

Ancient man's misconceptions of the source and movements of ground water are discussed. The first correct theories of Perrault, Mariotte, Halley and Darcy are described. The misconceptions and the first correct theories are traced to through their effect on the present ground water situation. (Heiss-NWWA) W76-05551

AQUIFER EVALUATION USING DEPOSI-TIONAL SYSTEMS: AN EXAMPLE IN NORTH-CENTRAL TEXAS,

Dames and Moore, Boca Raton, Fla. W. D. Hall, and L. J. Turk. Ground Water, Vol. 13, No. 6, p. 472-483,

November-December, 1975, 15 fig., 3 tab.

Descriptors: *Hydraulic properties, *Deltas, *Water chemistry, Permeability, Aquifer characteristics, Hydrochemical properties, Ion exchange, *Texas, Groundwater movement, Deposition(Sediments).

Identifiers: Hydrochemical facies, *Depositional systems, Fluvial systems, Hosston formation, Hensel formation, Flow pattern.

Delineation of major depositional systems and their component facies within the Lower Cretaceous Hosston and Hensel Sandstone Formations provides a model for predicting the dis tribution and chemical composition of water in the aquifer. Two major depositional trends occur in both formations: (1) a dip-oriented meanderbelt fluvial system which supplied sediment to (2) a strike-oriented delta system in the east. The mean derbelt sandstone facies of the fluvial systems and the coastal barrier facies of the delta systems are capable of supplying greater amounts of ground water than the floodbasin, lagoon-marsh-embay-ment, or prodelta/shelf facies. Chemical analysis of ground water suggests correlation between the hydrochemical facies and depositional facies. Ground water is dominantly of the calcium-magnesium bicarbonate type in the fluvial systems. The chemical character of the water changes downdip to sodium sulfate and sodium bicarbonate types in the delta systems. The change in chemical equilibrium probably occurs as dolomite-rich waters from the fluvial facies percolate downdip and dissolve anhydrite or oxidize pyrite in lagoonal facies within the delta system. Calcium may be exchanged for sodium on the marine clays. (Ukayli-NWWA) W76-05554

HISTORY OF GROUND WATER DEVELOP-

MENT, National Water Well Association, Worthington,

For primary bibliographic entry see Field 4B. W76-05556

GROUND WATER IS THE ONLY REAL RESERVE THIS COUNTRY HAS. For primary bibliographic entry see Field 4B. W76-05567

SATURATED-UNSATURATED TRANSIENT FLOW IN POROUS MEDIA: EX-PERIMENTAL AND NUMERIC MODEL. California Univ., Davis. Dept. of Water Science

and Engineering. J. N. Luthin, A. Orhun, and G. S. Taylor. Water Resources Research, Vol. 11, No 6, p 973-978, December 1975. 9 fig, 1 tab, 9 ref.

Descriptors: *Porous media, *Model studies, *Free surfaces, *Unsaturated flow, *Unsteady flow, Numerical analysis, Analytical techniques, Flow nets, Groundwater, Groundwater move-ment, Water wells, Potential flow, Moisture con-tent, Computer models, Dupuit-Forchheimer theory, Finite element analysis. Identifiers: *Finite-difference techniques, Sand

tank model, Sector tank model, Saturated-unsatu-

Experimental data were obtained from a sector tank for the transient flow toward a well. The data included both the saturated and the unsaturated flow region. The data were used to verify the accuracy of a computer solution using an implicit numerical procedure. Agreement between the two sets of data was good. The computer solution can be adapted to a wide variety of groundwater flow problems. (Prickett - ISWS) W76-05684

NORMAL MODE ANALYSIS OF THE LINEAR **EQUATION OF GROUNDWATER FLOW**

Department of the Environment, (England). Central Water Planning Unit. D. A. Nutbrown.

Water Resources Research, Vol 11, No 6, p 979-987, December 1975. 6 fig, 1 tab, 3 ref.

*Numerical analysis, *Computer models, *Unsteady flow, Equations, Groundwater movement, Confined water, Diffusion, Theis equation, Model studies, Simulation analysis, Hydrology. Identifiers: *Normal mode analysis, Linear equations, Finite differences, ADI method, Crank-Nicholson method, Diffusion equation.

The study of groundwater flow, given equations of motion and boundary conditions which are mathematically linear, can be analyzed by using a normal mode approach. For the fully continuous case the simplest example is the familiar double Fourier analysis. Analogous results exist for the semidiscrete case, in which only time is treated as a continuous variable, and a method can be given for computing normal modes whose corresponding recession factors lie within prescribed ranges. One application of this approach suggested an empirical form for the base flow component of a stream hydrograph. The fully discrete case was also treated and provided a convenient basis for the comparison of the more common approximations to the solution of the transient groundwater flow equation. In particular, it was shown why the study of model problems does not provide a useful guide to the accuracy of the alternating direction implicit method applied to more general situations.
(Prickett - ISWS) W76-05685

FORECASTING WATER AOUIFERS BY NUM LEVELS NUMERICAL AQUIFERS BY NU SEMIHYBRID METHODS,

Technion-Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.

Civil Engineering. E. Hefez, U. Shamir, and J. Bear. Water Resources Research, Vol. 11, No. 6, p 988-992, December 1975. 3 fig, 3 tab, 13 ref.

Descriptors: *Forecasting, *Water levels, *Aquifers, *Numerical analysis, *Hybrid compu-Descriptors: ters, Model studies, Computer models, Resistance networks, Equations, Boundaries(Surfaces), Artesian heads, Transmissivity, Recharge, Water wells, Analog models. Identifiers: *Noniterative alternating direction im-

plicit method, Cell models, Computation time.

Two methods which employ a cell model for forecasting water levels in aquifers were compared: the (noniterative) alternating direction implicit (ADI) finite difference method and a semihybrid iterative method, in which a resistor network is the analog part. By using simulation of the semihybrid method it was concluded that this method requires a larger computational effort than the ADI method. (Visocky - ISWS) W76-05686

AN IDENTIFICATION APPROACH TO SUB-SURFACE HYDROLOGICAL SYSTEMS, California Univ., Berkeley. Dept. of Civil En-

gineering. . Distefano, and A. Rath.

Water Resources Research, Vol. 11, No. 6, p 1005-1012, December 1975. 10 fig, 1 tab, 36 ref.

Descriptors: *Mathematical models, *Aquifer characteristics, *Transmissivity, Model studies, Subsurface waters, Aquifers, Groundwater, Mathematical studies. Observation wells. Hydrographs.

Identifiers: *Groundwater modeling, *Subsurface hydrological systems, Confined isotropic aquifer.

A method for the optimal determination of the transmissivity function in a model of a horizontal two-dimensional saturated aquifer, using time histories of the heads at a number of observation points, was developed. In this method the transmissivity function was assumed to be represented by a continuous spline surface over the entire domain of the aquifer and was given in terms of unknown nodal values disposed over a rectangular grid. These nodal values were then determined by requirements of optimality, i.e., by minimination of an error functional denoting the deviations of the observed and predicted heads at several strategi-cally distributed observation wells. The method

Group 2F-Groundwater

was complemented by using a hierarchical identifi-cation approach which consists of gradually in-creasing the number of nodal values employed in the analytical representation of the transmissivity function. Finally, a numerical example involving the determination of the transmissivity map of an aquifer by employing simulated head histories was presented to illustrate the feasibilty of the proposed method. (Sanderson - ISWS) W76-05688

DETERMINING AQUIFER COEFFICIENTS FROM RESIDUAL DRAWDOWN DATA, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.

A. Vanden Berg. Water Resources Research, Vol. 11, No. 6, p 1025-1028, December 1975. 2 fig, 1 tab, 4 ref.

Descriptors: *Aquifer characteristics. *Transmissivity, *Storage coefficient, *Least squares method, *Drawdown, Hydraulics, Aquifers, Groundwater, Permeasbility, Porous media, Mathematical studies, Theis equation, Nu-

merical analysis.
Identifiers: *Aquifer coefficients, *Residual drawdown data, Recovery data

Hantush's equation for the drawdown in a leaky. infinite aquifer, adapted to the residual drawdown, was used to obtain a least sum of squares fit to the residual drawdown measurements in an observation well by iteratively adjusting the transmissivity, storativity, and leakage factor. First estimates for the least squares method were obtained by first fitting the equation, with a fixed high value of the leakage factor, to two points of the data; this was followed by a number of fits to three points, each fit yielding a set of values for the three aquifer coefficients; the set which yielded the least sum of squares was selected as first estimate to the main routine. An application to data from a pump test at Chatham, New Brunswick, was shown as an example. (Sanderson - ISWS) W76-05689

VERTICAL ELECTRICAL RESISTIVITY SOUNDINGS TO LOCATE GROUND WATER RESOURCES: A FEASIBILITY STUDY,

Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.

For primary bibliographic entry see Field 4B. W76-05835

LAND SUBSIDENCE AND AQUIFER-SYSTEM COMPACTION IN THE SAN JACINTO VALLEY, RIVERSIDE COUNTY, CALIFORNIA--A PROGRESS REPORT,

Geological Survey, Sacramento, Calif.

B. E. Lofgren.

Journal of Research of the U.S. Geological Survey, Vol 4, No 1, p 9-18, January-February 1976. 10 fig, 16 ref.

Descriptors: *Land subsidence, *Aquifer systems, *Compaction, *Hydrogeology, *California, Hydrologic data, Geology, Water level fluctuations, Faults(Geologic), Seismology, Evaluation. Identifiers: *San Jacinto Valley(Calif).

Widespread subsidence continues in the San Jacinto structural trough in Riverside County, Calif., as water levels continue to decline. Subsidence is due principally to the compaction of water-bearing deposits as effective stresses are increased by artesian-head decline. Other possible contributory causes of subsidence are (1) local or regional tectonic adjustments and graben downfaulting, (2) natural compaction of deep water-bearing deposits below the bottom of well casins, and (3) continuing compaction of surficial deposits due to causes other than artesian-head decline. An analysis of 4 years of correlative records of water-level, extensometer, and land-surface changes suggests three types of vertical ground movement occurring at

the recorder site near the San Jacinto reservoir site. The reservoir was drained in October 1973. Listed in descending order of magnitude these are (1) an elastic undulation of the land surface of about 0.06 ft per year in close response to the roughly 50 ft of seasonal water-level fluctuations, (2) a long-term permanent compaction of the deposits in the 0-1,237-ft zone of about 0.04 ft per year, and (3) a deep settlement of deposits below the 1,237-ft extensometer anchor of 0.01-0.02 ft per year, probably caused by continuing downfaulting in the graben trough. (Woodard-W76-05847

A DIGITAL-COMPUTER MODEL FOR ESTI-MATING HYDROLOGIC CHANGES IN THE AQUIFER SYSTEM IN DANE COUNTY, WISCONSIN,

Geological Survey, Madison, Wis.

R. S. McLeod. Wisconsin Geological and Natural History Survey, Madison, Information Circular November 1975. 40 p, 24 fig, 4 tab, 8 ref.

Descriptors: "Water resources development,
"Groundwater resources, "Water supply,
"Projections, "Model studies, Digital computers,
Water yield, Drawdown, Groundwater recharge,
Surface-groundwater relationships, Streaflow, Data collections, Evaluation, Water utilization, Water demand, *Wisconsin.

Identifiers: Dane County(Wisc).

The extensive use of groundwater for water supply within Dane County, Wisconsin, has resulted in groundwater level declines and reductions in streamflow. Digital-computer modeling techniques were used to estimate hydrologic changes in the aquifer system that would caused by continued development. The system was modeled as a two-aquifer system consisting of a confined sandstone aquifer overlain by a leaky unconfined aquifer and underlain by impermeable bedrock. The physical properties of the aquifer system needed for the model were approximated using aquifer-test data and well-log data and by matching observed hydrologic changes in the system with corresponding changes computed by the model. Computed hydrologic changes do not represent a serious depletion of the available groundwater supply for the foreseeable future. Maximum added regional declines in groundwater levels (drawdowns) from 1970 to 1990 were computed to be approximately 10 feet (3 metres) in the unconfined aquifer and approximately 40 feet (12 metres) in the confined aquifer. It is computed that for the same period the average annual streamflow from the upper Yahara River basin would be reduced by approximately 29 cfs (0.82 cu m/sec). These changes are computed based on estimated development trends for the confined sandstone aquifer. (Woodard-USGS) W76-05851

EVALUATION OF DATA AVAILABILITY AND EXAMPLES OF MODELING FOR GROUND-WATER MANAGEMENT ON CAPE COD, MAS-SACHUSETTS,

Geological Survey, Boston, Mass. For primary bibliographic entry see Field 4B. W76-05856

FLORIDAN AQUIFER IN NORTHEAST FLORIDA--THREE MAPS--HARDNESS OF WATER, CHLORIDE CONCENTRATION, AND POTENTIOMETRIC SURFACE, MAY 1974, Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 7C. W76-05859

GEOHYDROLOGY OF THE EVANGELINE AND JASPER AQUIFERS OF SOUTHWESTERN LOUISIANA.

Geological Survey, Baton Rouge, La.

M. S. Whitfield, Ir.

Louisiana Department of Public Works, Baton Rouge, Water Resources Bulletin No. 20, 1975. 72 p. 11 fig. 9 plates, 2 tab.

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Descriptors: *Geologic mapping, *Aquifers, *Louisiana, *Groundwater resources, *Water quality, Data collections, Well data, Aquifer characteristics, Water yield, Water levels, Water utilization, Water supply, Groundwater movement, Groundwater recharge, Hydrogeology. Identifiers: Southwestern Louisiana, *Evangeline aquifer(La), *Jasper aquifer(La).

In southwestern Louisiana, interbedded continen-In southwestern Louisiana, interbedded continen-tal and marine deposits form a southeastward-thickening wedge of unconsolidated sediments that contain the fresh-water-bearing zone. These sediments range in age from late Tertiary to Pleistocene. The upper Tertiary deposits comprise the Evangeline and Jasper aquifer systems. These aquifers are capable of supplying large quantities of water that is of excellent quality to meet expanding industrial and municipal needs. Fresh groundwater occurs to a maximum depth of approximately 2,200 ft below sea level in the Evangeline aquifer and approximately 3,100 ft below sea level in the Jasper aquifer. Fresh water occurs in the Evangeline aquifer throughout the area of investigation except in central St. Landry Parish and in a small isolated area surrounding the Pine Prairie salt dome in Evangeline Parish. Fresh water occurs in the Jasper aquifer in most of Beauregard Parish and in the northwestern part of Allen Parish. Water from the Evangeline and Jasper aquifers is a sodium bicarbonate type, generally very soft (less than 40 milligrams per litre), and low in dissolved-solids concentration. Locally, the water may be hard, and iron or fluoride may occur in objectionable concentrations. Water from the upper part of the Jasper aquifer is similar in chemical quality to water from the Evangeline aquifer. Water from the lower part of the Jasper aquifer, however, generally is lower in iron concentration.
(Woodard-USGS) W76-05861

AVAILABILITY OF GROUND WATER IN THE ANDROSCOGGIN RIVER BASIN, NORTHERN NEW HAMPSHIRE,

Geological Survey, Concord, N.H. For primary bibliographic entry see Field 7C. W76-05862

PUMPING-TEST ANALYSIS USING A DISCRETE TIME-DISCRETE SPACE NUMERICAL METHOD.

Birmingham Univ. (England). Dept. of Civil Engineering.

For primary bibliographic entry see Field 4B. W76-05913

GROUNDWATER STUDY OF A VOLCANIC AREA NEAR BANDUNG, JAVA, INDONESIA, Cowiconsult Ltd., Copenhagen (Denmark). For primary bibliographic entry see Field 4B.

W76-05914

2G. Water In Soils

INTERACTIONS OF MERCURY WI' AQUATIC AND EDAPHIC ENVIRONMENTS, Kansas State Univ., Manhattan, Dept. of Agrono-

For primary bibliographic entry see Field 5B. W76-05601

GUIDELINES FOR CHARACTERIZING NATU-RALLY UNSTABLE OR POTENTIALLY UNSTABLE SLOPES ON WESTERN NATIONAL FORESTS,

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station.

For primary bibliographic entry see Field 4D. W76-05621

SPATIAL VARIABILITY OF IN SITU UNSATU-RATED HYDRAULIC CONDUCTIVITY OF MADDOCK SANDY LOAM,

North Dakota State Univ., Fargo. Dept. of Soils. H. O. Carvallo, D. K. Cassel, J. Hammond, and A. Bauer.

Soil Science, Vol. 121, No. 1, p 1-8 January 1976. 2 fig, 2 tab, 13 ref.

Descriptors: *Unsaturated flow, *Hydraulic conductivity, *Soil water movement, *On-site investigations, *Loam, *North Dakota, Tensiometers, Permeability, Porosity, Drainage, Infiltration, Percolation, On-site tests, On-site data col-lections, Instrumentation, Moisture content. Identifiers: *Soil water pressure, Soil water content, Lacustrine materials, Maddock sandy loam.

Unsaturated soil hydraulic conductivity (K) versus depth was measured in situ in five infiltration plots within a 0.01 hectare area on a soil developed from lacustrine materials in a glacial lake bed. Sufficient water was allowed to infiltrate each plot to wet the soil profile to 152 cm. The soil surface was covered to prevent evaporation and during the ensuing drainage period, soil water pressure was monitored with triplicate tensiometers at each depth of 15, 30, 45, 61, 91, 122, and 152 cm. Soil water characteristic data determined on triplicate cores taken from the same depth as the tensiometer cups, were used in conjunction with the soil water pressure head data to compute the hydraulic conductivity. Significant spatial variability of hydraulic conductivity at the 1% level was found. In addition, K significantly varied with depth, at the 1% level, generally increasing, due to the heterogeneous nature of soil in the vertical direction. Hydraulic conductivity as a function of porosity was computed for each site by the modified Green and Corey method. Agreement of these theoretical K values with those measured in situ depended on the soil water content at which the matching factor was selected. Agreement between methods was best when the matching factor was selected at the lowest water content at which K was measured in the field for that particular soil depth. (Sanderson-ISWS) W76-05670

SOME RELATIONS BETWEEN FOREST LITTER AND GROWTH OF SITKA SPRUCE ON POORLY DRAINED SOILS,

Queen's Univ., Belfast (Northern Ireland). Dept. of Agricultural and Food Chemistry. For primary bibliographic entry see Field 21. W76-05687

MOVEMENT OF TRACERS THROUGH SOIL, Ontario Ministry of the Environment, Toronto. Applied Science Section. For primary bibliographic entry see Field 5B.

SALT TRANSPORT IN SOIL PROFILES WITH APPLICATION TO IRRIGATION RETURN FLOW, THE DISSOLUTION AND TRANSPORT

OF GYPSUM IN SOILS, Colorado State Univ., Fort Collins. Dept. of

Agronomy.
For primary bibliographic entry see Field 5B.
W76-05836

W76-05701

SOLUTE TRAVEL-TIME ESTIMATES FOR TILE-DRAINED FIELDS: I. THEORY, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering. For primary bibliographic entry see Field 5B. W76-05904 SOLUTE TRAVEL-TIME ESTIMATE FOR THE-DRAINED FIELDS: II. APPLICATION TO EXPERIMENTAL STUDIES, California Univ., Riverside. Dept. of Soil Science

and Agricultural Engineering. For primary bibliographic entry see Field 5B. W76-05905

RECLAMATION OF SOILS CONTAMINATED WITH RADIOACTIVE STRONTIUM. Agricultural Research Service, Beltsville, Md. For primary bibliographic entry see Field 5G.

EFFECT OF SURFACE APPLIED SULFURIC ACID ON WATER PENETRATION INTO DRY CALCAREOUS AND SODIC SOILS.

Arizona Univ., Tuscon. Dept. of Soils, Water and Engineering. For primary bibliographic entry see Field 5G. W76-05907

INFLUENCING FACTORS INFILTRATION AND SEDIMENT PRODUCTION OF SEMIARID RANGELANDS IN NEVADA.

Texas A and M Univ., College Station. Dept. of Range Science W. H. Blackburn.

Water Resources Research, Vol. 11, No. 6, p 929-937, December 1975. 3 fig, 6 tab, 27 ref.

Descriptors: *Infiltration, *Erosion, *Sediment yield, *Watersheds(Basins), *Plant morphology, *Nevada, Soil structure, Antecedent moisture content, Simulated rainfall, Field capacity, Silts, Arid lands, Semiarid climates.

Identifiers: Dune interspace soils, Vesicular horizons

Simulated rainfall was used to study infiltration rates and sediment production of 28 plant communities and soils of five watershed areas in central and eastern Nevada. Two antecedent soil moisture conditions were used: soil initially air dry and initially at field capacity. Infiltration rates and sediment production of the various soils are largely controlled by extent and surface morphology of dune interspace soils. Pertinent factors are the depth of surface horizon, percent of carbon, pH, bulk density, and percent silt in the dunes. Vesicular horizons are unstable in dune interspace surface soils. These horizons seldom occur in coppice dunes or in well-aggregated dune interspace soils. Infiltration rate is negatively related, and sediment production positively related to the occurrence and morphology of vesicular horizons. More sedi-ment is produced from soils with antecedent moisture initially at field capacity than from initially dry soil because of the instability of vesicular horizons when the soils were saturated. (Singh-ISWS) W76-05912

SOIL MICRORES.

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. W R Rollen

For sale by the Superintendent of Documents U S. Government Printing Office, Washington, D.C. 20402. In: Environmental Effects of Forest Residues Management in the Pacific Northwest. State of Knowledge Compendium. USDA Forest Service Technical Report, PNW-24, p. B-1 to B-41 1974. 11 tab, 5 fig, 89 ref.

Descriptors: *Soil microorganisms, *Cycling nutrients, Chemical reactions, Temperature, Aeration, Hydrogen ion concentration, Forest soils, Microenvironment, Microbial degradation, Forest management. Identifiers: Residue decomposition.

Interactions between soil microbes and forest residues are controlled by six environmental fac-

tors: water, temperature, aeration, pH, food supply, and biological interrelationships. A change in one induces change in others. Burning drasti-cally affects all six but is especially unfavorable in terms of nitrogen loss and effects on soil physical properties. Microbial decomposition of residues, in contrast, recycles the nitrogen and can result in improved soil physical properties. Microbial activity can be enhanced by reducing particle size of residues, by providing good contact between residue fragments and soil, and by adding nitrogen by fertilization or establishment of plants with nitrogen-fixing nodules. Petroleum products, bio-cides, or fire retardants appear unlikely to significantly affect soil microbial activity or residue decomposition when used at recommended rates. Forest residues combined with soil microbes offer promise for disposal ofsewage waste water and decomposable garbage. (Forest Service) W76-05935

SOIL PROCESSES AND INTRODUCED CHEMI-

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4C. W76-05936

SOIL STABILITY AND WATER YIELD AND QUALITY, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D. W76-05937

WATER MOVEMENT WITHIN THE ROOT ZONE OF IRRIGATED AND NONIRRIGATED GRAIN SORGHUM,

South Dakota State Univ., Brookings, Dept. of Plant Science.

L. R. Stone, and M. L. Horton. Journal of Soil and Water Conservation, Vol. 30, No. 6, p 292-293, November-December 1975. 3 fig, 7 ref. OWRT A-035-SDAK (1).

Descriptors: *Soil water movement, *Root zone, Grain sorghum, *Irrigation, Solutes, Nutrients, Grains(Crops), Unsaturated flow, Evapotranspiration, Loam, Tensiometers, Potentiometric level, Hydraulic conductivity, Darcys law, Depth, Salts, Soil profiles, Perched water.

Identifiers: *Great Bend silt loam.

Water movement and redistribution are important in supplying nutrients and water to plants. Water movement and redistribution during August 1972 in fields of irrigated and nonirrigated grain sorghum were determined. Soil water flux in the non-irrigated area was upward in all soil-depth in-tervals during the study. Upward flux in the 15- to 30-, 30- to 50-, and 50- to 70- cm depths decreased with time. Upward flux in the 130- to 150-cm depth reached a maximum of 0.17 cm per day and then remained near 0.11 cm per day. Immediately after irrigation, flux was downward in all soil depth in-tervals in the irrigated sorghum. Flux in the 130-to 150-cm depth remained downward. Flux in the 15to 30-, 30- to 50-, and 50- to 70-cm depths turned upward within one week after irrigation. (Visocky ISWS) W76-05994

CARBON DIOXIDE EVOLUTION FROM VIR-GIN AND CULTIVATED SOIL AS AFFECTED BY MANAGEMENT PRACTICES AND CLI-MATE.

Saskatchewan Univ., Saskatoon. Dept. of Soil

E. DeJong, H. J. V. Schappert, and K. B. Macdona

Can J Soil Sci. 54(3): 299-307, 1974.

Descriptors: Soil properties, *Climates, *Soil management, *Clays, Respiration, *Soil physical

Group 2G-Water In Soils

properties, *Soil chemical properties, *Carbon dioxide, *Soil gases.

Soil respiration during the growing season was calculated from CO2 profiles in a heavy clay soil under native grass and on cultivated plots. Soil respiration of the native grass plots was correlated with moisture content and temperature of the surface soil. However, the correlation accounted for only 1/3 of the observed variation in soil respiration and could not explain the large difference between 2 growing seasons. Addition of mineral N decreased soil respiration and irrigation increased it. Total soil respiration on the cultivated plots was higher than on the native grassland. On the wheat plots, soil respiration was significantly correlated with soil moisture but not with temperature; the reverse was true for the fallowed plots. Soil respiration during 1 May-1 Sept. on the native grassland was highly correlated with rainfall and the number of days with rain in excess of 5 mm. The number of wetting and drying cycles in the soil was mainly responsible for the annual variation in soil respiration. From comparison with data on shoot production, it appears that soil respiration exceeds net production in wet years and that the opposite is true in dry years .-- Copyright 1975, Biological Abstracts. Inc. W76-06003

EFFECT OF DEPTH AND SALINITY OF GROUND WATER ON EVAPORATION AND SOIL SALINIZATION,

Central Soil Salinity Research Inst., Karnal (India).

For primary bibliographic entry see Field 2D. W76-06036

EVAPORATION CHARACTERISTICS FINE-TEXTURED TARAI SOILS VARIOUS EVAPORATION POTEN-THREE UNDER

TIALS, Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Soil

For primary bibliographic entry see Field 2D. W76-06037

RESPONSE OF SOIL TESTACEA TO SOIL MOISTURE FLUCTUATIONS,

Calgary Univ. (Alberta). Dept. of Biology. J. D. Lousier.

Soil Biol Biochem. 6(4): 235-239. 1974.

Descriptors: *Soil moisture, *Rocky Mountain Region, Trees, Forest management.
Identifiers: *Aspen, *Testacea, Woodlands.

As soil moisture increased in a Rocky Mountain aspen woodland soil-litter system, all species of Testacea recorded showed a significant increase in number of active individuals and a proportionate sugnificant decrease in the number of cysts. The trends were less evident in the A0L layer because of low variation in moisture content compared to the A0F and A0H layers. At higher soil moisture the larger species present (>60 mm) tended to retain a larger proportion of living individuals as cysts than did the smaller forms (< 60 mm) which numerically dominated the population.--Copyright 1975, Biological Abstracts, Inc. W76-06038

THE MICROENVIRONMENT OF CLIMACIUM

AMERICANUM,
Platte Technical Community Coll., Columbus, Nebr

R. D. Sholl, and J. D. Ives.

Trans Ill State Acad Sci. 66(3/4): 97-104. 1973.

*Mosses, Descriptors: Environment. *Evaporation, Temperature, Humidity, Soil temperature, Soil moisture, Organic matter. Identifiers: Climacium-Americanum.

Maximum and minimum temperatures and relative humidity of the air at 1 cm above the soil surface, soil temperature, potential evaporation rate, soil moisture and organic matter present in the soil were measured for 5 plots that appeared to be very similar habitat types. The plots on which C. amer-icanum occur were found to have relatively low maximum and minimum temperatures, high relative humidity of the air layer directly over the plots, relatively low rates of potential evaporation, relatively low soil temperatures, and soils that are moderately acidic. Each of the plots on which C americanum does not occur was found to be notably different in terms of one or more of the environment factors measured than the plots where C. americanum is present.--Copyright 1974, Biological Abstracts, Inc. W76-06045

THE PERFORMANCE OF SURFACE AND SUBSURFACE DRAINAGE OF HEAVY CLAY SOILS IN YUGOSLAVIA,

J. M. Groot. Neth J Agric Sci. 22(3), p 160-174, 1974.

Descriptors: *Soil, Soil water movement, Subsurface drainage, *Clays, Rainfall, Permeability. Identifiers: Cropping, Reclamation, Yugoslavia, Sava River

Field drainage methods were investigated on soils in the Sava River Basin, Yugoslavia, which have a well-permeable topsoil of about 0.3 m underlain by well-permeable subsoil. The systems tried were tube drainage at about 1.0 m depth, surface drainage with open field ditches and mole drainage. Under rainfall, horizontal flow through the topsoil takes place. The formulas for both the steady and non-steady state that apply to this flow are presented. These formulas together with field ervations about accessibility of the fields have rendered it possible to derive the drainage requirements for the climatological conditions and the soils as prevalent in the area. Partly because of mechanization subsurface drains are preferred; subsurface drains provide better drainage than surface drains, particularly during reclamation and the 1st years of cropping. Under the soil conditions prevailing in the area, flow over the surface is likely to occur. The factors determining the peak discharges of field drains are discussed.--Copy-right 1975, Biological Abstracts, Inc. W76-06116

BEHAVIOUR OF SOME PHOSPHATIC FERTIL-IZERS IN WATER, Khatauli Manure Mills, Khatauli (India).

For primary bibliographic entry see Field 5B. W76-06139

APPLICATION OF INFRARED SPECTROSCO-PY TO ERODIBILITY STUDIES OF THE SOIL, Allahabad Univ. (India). Dept. of Chemistry. For primary bibliographic entry see Field 2J. W76-06140

STUDIES ON DEPTH AND QUALITY OF WATER ON SOIL SALINIZATION:
BEHAVIOUR OF ANIONS IN THE SOIL
PROFILE WITH REFERENCE TO THE POSI-TION OF WATER TABLE,

Central Soil Salinity Research Inst., Karnal (India)

A. K. Bandyopadhya. J Indian Soc Soil Sci. 21(4), p 485-489, 1973.

Descriptors: Saline soils, Water quality, Anions, Soil profiles, Water table, Calcium, Carbonates, Ions, Bicarbonates.

The behavior of chloride, sulfate and bicarbonate ions in the soil profile with reference to the position of the water table is discussed. A possible ex-planation of the formation of calcium carbonate concretions in the soils is given.--Copyright 1974, Biological Abstracts, Inc. W76-06141

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2H. Lakes

HYDROLOGIC IMPLICATIONS OF CANYON DAM AND RESERVOIR,

National Weather Service Forecast Office. Washington, D. C.

In: 'Reservoir Impact Study,' p. 4.i--4.24. November 1974. 10 fig, 6 tab, 3 ref.

Descriptors: *Reservoir design, *Reservoir operation, Reservoir storage, Inflow, Reservoir leakage, Reservoir evaporation, Reservoir releases, Flood frequency, Flood flow, Texas, Post-impoundment.

*Canyon Identifiers: Reservoir(Texas). Guadalupe River(Texas).

Canyon Dam was designed for the primary purpose of reducing flood damages in the lower reaches of the Guadalupe River, Texas. A relatively large conservation capacity has been allowed to provide a firm water supply for downstream users. The total capacity for flood control is 354,700 acre feet. The total contributing drainage area at the dam site is 1432 square miles. The study period during July 1962 through September 1971 utilized precipitation, inflow, evaporation, observed capacity, and outflow information to determine the hydrologic impact of the reservoir on the water regime of the Guadalupe River. The net lake surface evaporation is almost equal to the effective rainfall. When the reservoir is full to the top of conservation storage it represents 22,700 acre feet per year or approximately 5.9% of the conservation capacity. The estimated monthly inflow has ranged from 296 acre feet to 151,750 acre feet. The observed flood peaks on the Guadalupe River were less than 10,000 cfs with the exception of the flood peak of approximately 92,600 cfs occurring in May 1972 at New Braunfels. Leakage has proved insignificant and the reservoir has had little or no impact on groundwater levels of the surfaceimpact region. (See also W76-04501) (Auen-Wisconsin). W76-05503

EVALUATION OF THE TROPHIC TYPES OF SEVERAL ALASKAN LAKES BY ASSESSMENT OF THE BENTHIC FAUNA,

Alaska Univ., College. Inst. of Water Resources. For primary bibliographic entry see Field 5C. W76-05604

PHOSPHORUS, NITROGEN, AND GROWTH OF ALGAE IN LAKE KINNERET, Kinneret Limnology Lab., Tiberias (Israel). For primary bibliographic entry see Field 5C. W76-05633

CHEMICALLY ENHANCED C02 GAS EXCHANGE IN A EUTROPHIC LAKE: A GENERAL MODEL, Lamont-Doherty Geological Observatory, Palisades, N.Y. For primary bibliographic entry see Field 5C.

A DESCRIPTION OF THE TROPHIC STATUS AND NUTRIENT LOADING FOR LAKE GEORGE, NEW YORK, Rensselaer Polytechnic Inst., Troy, N. Y. Fresh

For primary bibliographic entry see Field 5C. W76-05638

W76-05635

LAKE AND SHORE ICE CONDITIONS ON LABE AND SHOKE ICE CONDITIONS ON SOUTHEASTERN LAKE MICHIGAN IN THE VICINITY OF THE DONALD C. COOK NUCLEAR PLANT: WINTER 1973-74, Michigan Univ., Ann Arbor. Great Lakes Research Div.

For primary bibliographic entry see Field 2C. W76-05664

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DEVELOPMENT OF OXYGEN DEFICITS IN 14 SOUTHERN ONTARIO LAKES, Trent Univ., Peterborough (Ontario). Dept. of

For primary bibliographic entry see Field 5C. W76-05679

SELECTED WATER-QUALITY DATA FROM FALLEN LEAF LAKE, EL DORADO COUNTY, CALIFORNIA, JUNE THROUGH OCTOBER

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 7C. W76-05848

TABLE OF DATA ON WATER QUALITY OF BAKER LAKE NEAR MOUNT BAKER, WASHINGTON.

Geological Survey, Tacoma, Wash. For primary bibliographic entry see Field 7C. W76-05857

ENVIRONMENTAL RESPONSES TO THER-MAL DISCHARGES FROM MARSHALL STEAM STATION, LAKE NORMAN, NORTH

Johns Hopkins Univ., Baltimore, Md. Dept of Geography and Environmental Engineering. For primary bibliographic entry see Field 5C. W76-05870

INTRODUCTION AND PHYSICAL DESCRIP-

TION OF LAKE NORMAN,
Johns Hopkins Univ. Baltimore, Md. Dept. of Geography and Environmental Engineering. For primary bibliographic entry see Field 5C. W76-05871

THERMAL AND WATER QUALITY CHARAC-

TERISTICS OF LAKE NORMAN, Johns Hopkins Univ., Baltimore, Md., Dept. of Geography and Environmental Engineering. For primary bibliographic entry see Field 5C. W76-05872

THE EFFECT OF THERMAL DISCHARGE ON THE RATE OF ACCUMULATION OF ORGANIC SUBSTANCES ON GLASS SURFACES IMMERSED IN LAKE NORMAN, Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering. For primary bibliographic entry see Field 5C.

W76-05875

BENTHIC INVERTEBRATES,

Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering For primary bibliographic entry see Field 5C. W76-05877

THE CHEMICAL SPECIATION OF PU-239, PU-240 AND CS-137 IN LAKE MICHIGAN WATERS.

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05889

DISCHARGE RESIDENCE OF TLD TAGGED

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

For primary bibliographic entry see Field 5C.

BODY TEMPERATURE CHANGE CHARAC-TERISTICS OF LAKE MICHIGAN FISHES, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5C. W76-05899

BODY TEMPERATURES OF FISH FEEDING IN THE POINT BEACH THERMAL DISCHARGE, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5C. W76-05900

GROWTH OF PLUME RESIDENT FISHES IN LAKE MICHIGAN, Argonne National Lab., Ill. Radiological and En-

vironmental Research Div. For primary bibliographic entry see Field 5C.

EFFECT OF PLUME RESIDENCE ON THE AC. CUMULATION OF CS137 BY LAKE MICHIGAN SALMONIDS,

Argonne National Lab., Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5C.

W76-05902

PARASITES OF FRESHWATER FISHES. A REVIEW OF THEIR CONTROL AND TREAT-MENT

G. L. Hoffman, and F. P. Meyer. T.F.H. Publications, Inc.: Neptune City, N.J., 1974, 224 p.

Descriptors: *Fish parasites, Freshwater fish, Fish diseases.

This is the first review of the subject since 1928. Included are chapters on methods, conversion in-formation, synopsis of the most widely used treatments, glossary, tables of methods reported with references, toxicity of parasiticides and chemical synonyms. There are 390 references. Most unusual in parasitology is the inclusion of 105 color photographs of fish parasites. This book is intended for fish disease researchers and attribute of the color photofish disease researchers and students, fish pathobiologists, fish culturists and aquarists.—Copyright 1975, Biological Abstracts, Inc. W76-05953

LAKE WINGRA, 1837-1973: A CASE HISTORY

OF HUMAN IMPACT, Univ. Wis., Madison, Wisconsin Univ., Madison. For primary bibliographic entry see Field 5C. W76-05997

NEMATODES OF LAKE BALATON: IV. SEASONAL QUALITATIVE AND QUANTITA-

TIVE CHANGES, Research Inst. for Water Resources Development. Budapest (Hungary). Water Quality and Technolo-

gy Dept. For primary bibliographic entry see Field 5C. W76-06004

LIMNOLOGICAL CHARACTER OF EXPERI-MENTAL RESERVOIRS TREATED WITH TRITOX 30% (DDT, DMDT, GAMMA HCH), National Inst. of Hygiene, Warsaw (Poland). Dept.

of Communal Hygiene, Warsaw (Poland). For primary bibliographic entry see Field 5C. W76-06012

CHANGES IN THE LIMNOLOGICAL FEA-TURES OF A MEROMICTIC LAKE SUIGETSU DURING THE YEARS, 1926-1967, Nagoya Univ. (Japan). Water Research Lab. M. Matsuvama. J Oceanogr Soc Jpn. 29(4): 131-139. 1973.

Descriptors: Lakes, Limnology, Solinity, Stratification, Chlorides, Salt water, Water pollution

Identifiers: *Meromictic lakes, *Lake Suigetsu(Japan), *Polyhaline coastal lakes.

Changes in the limnological features of a typical meromictic lake, Lake Suigetsu, from 1926-1967, are summarized. Until 1934, the lake was stratified due to the balance between the flushing of fresh water and the intrusion of salt water through a canal by which the lake was connected to a coastal polyhaline lake. Total chloride content of the lake had been within the range of 100-230 x 1000 tons and thermal stratification was well developed. In 1934, another channel was constructed by which the lake was connected to another polyhaline coastal lake. This resulted in the influx of large quantities of salt water (maximum total chloride content of the lake: 790 x 1000 tons), and the characteristics of stratification were altered. After 1951, a 2-layered system was re-established (total chloride content of the lake: 470-620 x 1000 tons), and distinct stratification began to appear.--Copy-right 1975, Biological Abstracts, Inc.

ON THE POSSIBILITIES OF AVERAGING THE SEASONAL PATTERN IN KJELDAHL NITROGEN IN A GROUP OF WATER BODIES, Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Laborator. For primary bibliographic entry see Field 5B. W76-06019

LIMNOLOGICAL FEATURES OF A TROPICAL IMPOUNDMENT, BHAVANISAGAR RESER-VOIR (TAMIL NADU), INDIA,

Hydrobiological Research Station, Madras (India). For primary bibliographic entry see Field 5C.

ON DIPLOSTOMOSIS OF THE GRASSCARP FRV.

Acta Vet Acad Sci Hung. Vol 24 No 1/2 p 63-71. 1974. Illus.

Descriptors: *Trematodes, *Fish parasites, Carp. Fry. Identifiers: Diplostomosis. Diplostomum spathaceum.

Infestation by cercariae of Diplostomum spathaceum killed 90% of the 3-wk-old, 1.7-2.5 cm long grasscarp (Ctenopharyngodon idella) fry reared in a fingerling pond. The severely diseased hosts harbored an average of 20-25 larvae in the occular lens and 10-15 migrating stages in other parts of the body. Cercarial migration caused hemorrhages, visible externally. Most cercariae established in the eye or adjacent areas were surrounded by proliferative tissue.--Copyright 1975, Biological Abstracts, Inc. W76-06025

MACROVEGETATION AND ECOLOGICAL FACTORS IN TWO NORWEGIAN LAKES, Oslo Univ. (Norway). Dept. of Limnology, and Oslo Univ. (Norway). Inst. of Marine Biology. For primary bibliographic entry see Field 5C. W76-06044

Group 2H-Lakes

SEASONAL VARIATION IN DISSOLVED CAR-BOHYDRATE (DCHO) CONTENT IN THREE FRESHWATER PONDS, Central Marine Fisheries Research Inst., Cochin

(India). S. Vijayaraghavan.

S. Vijayaraghavan. Indian J Fish. 20(1), p 157-165, 1973.

Descriptors: *Ponds, *Carbohydrates, Chlorophyll.
Identifiers: Dissolved carbohydrates, *India.

Seasonal variations in dissolved carbohydrate (DCHO) were studied in 3 tropical freshwater ponds for a period of 1 yr. In Othakadai Pond the DCHO values varied from 0.3-20.0 mg/l, the range of variation in Teppakulam Tank was from 1.6-28.1 mg/l and in Yanamalai Pond it fluctuated from 0.3-27.5 mg/l. Fluctuations in DCHO content was related to chlorophyll a values only during a part of the annual cycle which indicates that plant organisms probably utilize the DCHO.—Copyright 1975, Biological Abstracts, Inc.

OBSERVATIONS ON THE SEASONAL FLUCTUATIONS OF PLANKTON IN THE CHILKA LAKE.

LAKE, Central Inland Fisheries Research Inst., Cuttack (India). Fisheries Research Station.

Indian J Fish. 20(1), p 43-55, 1973.

Descriptors: *Plankton, Phytoplankton, *Copepods, *Diatoms, Zooplankton. Identifiers: *Chilka Lake(India), India.

An account is given of the main features of the plankton of Chilka Lake (India) from April, 1964-March, 1965. The seasonal fluctuations of the main constituent groups of phytoplankton and zooplankton in relation to some of the environmental variables are discussed. The diatoms and copepods formed the dominat groups in the plankton during the above period.—Copyright 1975, Biological Abstracts, Inc.

STUDIES ON THE CA, MG, AND SR CONTENT OF FRESHWATER CLAMSHELLS, Texas Univ. at Dallas, Richardson.

G. F. Lee, and W. Wilson.
Trans Wis Acad Sci Arts Lett. 62, p 173-180, 1974.

Descriptors: *Clams, *Calcium, *Magnesium, *Strontium, *Wisconsin, Mollusks, Shellfish, Freshwater.

Identifiers: Lake Mendola(Wis), Lake Fox(Wis), Lake Trout(Wis), Shells.

The relationship of Ca, Mg and Sr in Lakes Mendota, Fox and Trout in Wisconsin and clamshells collected from these lakes shows a negative correlation between shell and water Sr/Ca ratio. The Mg/Ca ratio showed considerable scatter and in general a direct relationship between shell composition and water composition.--Copyright 1975, Biological Abstracts, Inc.

GENERIC COMPOSITION AND NUTRITIONAL REQUIREMENTS OF BACTERIA ISOLATED FROM THREE LAKES,

Nicolas Copernicus Univ. of Torun (Poland). Lab. of Microbiology.

W. Donderski, and E. Strzelczyk.

W. Donderski, and E. Strzelczyk.

Acta Microbiol Pol Ser B Microbiol Appl. 6(2), p
67-74, 1974.

Descriptors: *Bacteria, *Benthos, *Lakes, Plankton, Amino acids, Nutrient requirements, Eutrophication, Vitamins, Growth rates. Identifiers: Arthrobacter, Corynebacterium, Pleomorphism, Nocardia.

Studies were carried out on generic composition and nutritional requirements of planktonic and benthic bacteria isolated from I mesotrophic and 2 eutrophic lakes. The majority of benthic bacteria were identified as pleomorphic types (Arthrobacter-Corynebacterium group and the genus Norcardia). Also the genus Bacillus was quite common among the benthic isolates. Most of the benthic and planktonic bacteria required the presence of either amino acids or amino acids and vitamins for their best growth.—Copyright 1975, Biological Abstracts, Inc.

DIFFERENTIAL RESPONSES TO DROUGHT IN TWO SPECIES OF FUNDULUS, Miami Univ., Coral Gables, Fla. Dept. of Biology.

Miami Univ., Coral Gables, Fla. Dept. of Biology J. A. Kushlan. Copeia. 1973 (4), p 808-809, 1973.

Descriptors: *Drought tolerance, *Killifishes, *Florida, Fish behavior, Swamps, Fish reproduction, Drought resistance. Identifiers: Fundulus-Chrysotus, Fundulus-Con-

fluentus, *Big Cypress Swamps(Fla).

The golden topminnow (F. chrysotus) and the marsh killifish (F. confluentus) differed in their behavioral responses to lowering water levels in Big Cypress Swamp, Florida, during the spring drought of 1970. F. chrysotus became concentrated in the remaining pool of water while F. confluentus massed along its periphery. The distinct responses of the 2 spp. may relate to differences in reproductive strategy.—Copyright 1974, Biological

Abstracts, Inc. W76-06132

YEASTS ISOLATED FROM SOME LAKES AND RIVERS OF SASKATCHEWAN, National Research Council of Canada, Saskatoon (Saskatchewan) Prairie Regional Lab.

For primary bibliographic entry see Field 5B. W76-06135

SEASONAL DYNAMICS AND PRODUCTIVITY OF TANYTARSUS BARBITARSIS FREEMAN (DIPTERA:CHIRONOMIDAE) IN THE BENTHOS OF A SHALLOW, SALINE LAKE, Mount Allison Univ., Sackville (New Brunswick). Dept. of Biology.
For primary bibliographic entry see Field 5C. W76-06142

DISTRIBUTION OF FISH IN INLAND SALINE WATERS IN VICTORIA, AUSTRALIA, Monash Univ., Clayton (Australia). Dept. of

Zoology.
B. C. Chessman, and W. D. Williams.
Aust J Mar Freshwater Res. 25(1), p 167-172, 1974.

Descriptors: *Australia, *Fish, *Distribution, *Saline lakes, Lakes, Salinity, Invertebrates. Identifiers: Victoria.

The distribution of fish in Victorian saline lakes is discussed. Fourteen native and 5 exotic species are recorded from lakes of salinity greater than 3%, but no strictly inland species were found at salinities in excess of 31%. Reasons for the reduced penetration of fish into Victorian salt lakes compared with invertebrate penetration and fish penetration elsewhere are discussed.—Copyright 1974, Biological Abstracts, Inc. W76-06143

DYNAMICS OF BENTHIC INVERTEBRATES IN A TROPICAL MAN MADE LAKE (VOLTA LAKE 1964-1968): STANDING CROP AND BATHYMETRIC DISTRIBUTION.

Monash Univ., Clayton (Australia). Dept. of Zoology. For primary bibliographic entry see Field 5C. W76-06144 SEASONAL DISTRIBUTION OF PHYTOPLANKTON IN KINJHAR (KALRI)

LAKE, Univ. Karachi, Karachi, Pak. Dep. Zool., Karachi Univ. (Pakistan). Dept. of Zoology. For primary bibliographic entry see Field 5C. W76-06146

EURASIAN WATER-MILFOIL IN MICHIGAN, Auckland Univ. (New Zealand). Dept. of Botany. For primary bibliographic entry see Field 5G. W75.06.140

2I. Water In Plants

SOME RELATIONS BETWEEN FOREST LITTER AND GROWTH OF SITKA SPRUCE ON POORLY DRAINED SOILS, Queen's Univ., Belfast (Northern Ireland). Dept.

of Agricultural and Food Chemistry. S. N. Adams. J Appl Ecol. Vol 11 No 2 p 761-765, 1974.

Descriptors: *Organic matter, Litter, Forest soils. Identifiers: Picea Sitchensis, *Forest litter, Sitka spruce.

Forest floor litter was sampled from 64 good and 55 bad plots of Sitka spruce (Picea sitchensis) on gleved soils in Northern Ireland. On 69 of the 119 sites, a peaty horizon overlaid the gleyed mineral soil. The chemical analyses of the litters were related to tree age and growth. As the trees became older, the litter became more acid and some N was accumulated in it. Since these effects were rather small, there was little evidence that Sitka spruce was causing serious site degradation. Gleys with a was causing serious site organization. Gley's with a peaty horizon had a higher proportion of bad plots. The pedological factors which cause organic matter accumulation and which give rise to peaty gleys are also unfavorable to tree growth. When the effect of soil type was eliminated, litters under bad trees contained significantly less N than did those under good trees. There was no significant difference in the content of any other nutrient. It is suggested that the bad trees are N deficient. Copyright 1975, Biological Abstracts, Inc. W76-05687

RELATION OF THE CONSUMPTIVE USE COEFFICIENT TO THE DESCRIPTION OF VEGETATION,

Geological Survey, Tucson, Ariz. For primary bibliographic entry see Field 2D. W76-05843

RELATION OF WATER LEVEL AND FISH AVAILABILITY TO WOOD STORK REPRODUCTION IN THE SOUTHERN EVERGLADES, FLORIDA,

GLADES, FLORIDA, Geological Survey, Tallahassee, Fla. J. A. Kushlan, J. C. Ogden, and A. L. Higer. Open-file report 75-434, 1975. 56 p, 10 fig, 4 tab, 11 ref.

Descriptors: *Environmental effects, *Ecology, *Wading birds, *Marshes, *Florida, Food chains, Fish, Nesting, Birds, Hydrology, Balance of nature, Surface waters, Discharge(Water), Water levels.

Identifiers: *Southern Everglades(Fla), *Wood levels.

The wood stork is a species of colonial wading bird in the Florida Everglades that is most sensitive to changes in the availability of food. Previous studies have shown that the initiation and success of wood stork nesting depends on high densities of fish concentrated in ponds and other catchment basins during the dry season. The extreme dependence of the wood stork on the cyclic hydrologic regime of the southern Florida wetlands makes it an indicator of the well-being and ecological sta-

bility of the Everglades. The wood stork has declined in numbers over the last 25 years. One reason for the decline in the wood stork population was the change in the hydrologic regime of the Everglades which affected the feeding habitat and the food production. (Woodard-USGS) W76-05850

FACTORS INFLUENCING INFILTRATION AND SEDIMENT PRODUCTION OF SEMIARID RANGELANDS IN NEVADA,
Texas A and M Univ., College Station. Dept. of

Range Science. For primary bibliographic entry see Field 2G.

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IRRIGATING SEEDLING TEA IN SOUTHERN TANZANIA: EFFECTS ON TOTAL YIELDS, DISTRIBUTION OF YIELD AND WATER USE. Tea Research Inst. of East Africa, Kericho (Kenya). M. K. V. Carr.

J Agric Sci. Vol 83 No 2, p 363-378, 1974. Illus.

Descriptors: Crop production, Irrigation efficien-

Identifiers: Tea seedlings, Tea yield, Tanzania.

In a dry area of Southern Tanzania with a single rainy season irrigation during the 6 mo. long dry season (May-Nov.) doubled the total amount yield of tea and at the same time evened its distribution over the yr to some extent. Other factors including low temperatures limited growth rates during the period June-Sept. despite irrigation, while a lull in production in Nov. appeared to be unrelated to ex-ternal factors. Roots were traced to depths of about 4.3 and by the end of the dry season unirrigated bushes were drying the soil below 3 m. In general total yields decreased with decreasing frequency of irrigation and quantity of water applied but because these plants were deep rooting they could withstand deficits up to 100 mm without a reduction in yield, equivalent to a loss of about 25% of the total available water in the profile. There was some evidence that the most economical use of water occurred when the soil was not rewetted to field capacity at each irriga-tion, although yields were then less. Irrigation also reduced the incidence of a stem canker, Phomopsis theae. The implications of these results to the tea industry of East Africa are discussed.—Copy-right 1975, Biological Abstracts, Inc. W76-05928

WATER AND PHOSPHATE TRANSPORT TO

PLANT ROOTS, Royal Veterinary Royal Veterinary and Agriculture C Copenhagen (Denmark). Hydrotechnical Lab. B. F. Jakobsen.

Acta Agric Scand. 24(1): 55-60. 1974.

Descriptors: *Plant growth, *Root systems, *Water transfer, *Phosphates.

Solutions of the steady rate equation for water flow and phosphate diffusion to plant roots were found. Evaluations of their validity in different cases and formulas for the calculation of time lag for these solutions are given. For water movement, soil resistance is usually small, whereas it constitutes the major resistance to phosphate transport. In soils with high adsorption capacity for shoenhate end at least the seed of the state of the seed for phosphate and at low root density, the conditions for steady rate transport of phosphate are not reached in an acceptable time. -Copyright 1975, Biological Abstracts, Inc. W76-06002

THE INDIGENOUS TREES OF THE HAWAIIAN ISLANDS,

J. F. Rock

2nd Ed. 548p. Pacific Tropical Botanical Garden: Lawai, Hawaii, Charles E. Tuttle Company: Rutland, Vt., Tokyo, Japan. 1974. \$22.50.

Descriptors: *Hawaii, *Trees, Dicots, Ecology. Jescriptors: Hawaii, Trees, Dicots, Ecology.
Identifiers: Clermontia, Coprosma, Cyanea,
Euphorbia, Liliaceae, Metrosideros,
Neowawraea-phyllanthoides, Palmae, Pandanaceae, Pittosporum, Platydesma, Santalum,
Sideroxylon, Solanum, Straussia, Urera, Xanthoxylum.

This reprint edition of the 1913 publication describes and keys the indigenous trees (Pandanaeae, Liliaceae, Palmae and 39 dicot families) of the Hawaiian Islands. Descriptions of the botanical regions of the Hawaiian Islands are included. Keys to the species and genera are provided. The following new taxa (in 1913) are detailed: 2 new varieties and 1 new species in Pit-tosporum; 6 new varieties and 1 new species in Xanthoxylum; 4 new varieties and 5 new species in Pelea; Neowawreae phyllanthoides; 1 new spe-cies, 1 new variety and 1 new combination in Sideroxylon; 1 new species in Solanum; 2 new species and 3 new varieties in Straussia; 2 new species in Coprosma; 5 new species and 3 new varieties in Clermontia; 5 new varieties and 6 new species in Cyanea; and 1 new variety each in Urera, Santalum, Platydesma, Euphorbia and Metrosideros. Over 200 photographs illustrate the species' descriptions. Misidentified species and updating of the nomenclature are included in the addenda. Indices to the scientific and English and Hawaiian common names are provided.--Copyright 1975, Biological Abstracts, Inc. W76-06005

BIOLOGY AND BIOENERGETICS OF GRASS (CTENOPHARYNGODON CARP IDELLA

Polish Academy of Sciences, Warsaw. Inst. of Experimental Biology.

Z. Fischer, and V. P. Lyakhnovich.

Pol Arch Hydrobiol. 20(4): 521-557. 1973.

Descriptors: *Carp, Fish, *Fish reproduction, Europe, *Growth stages.
Identifiers: Ctenopharyngodon-Idella, *Grass carp, Amur River(USSR).

The grass carp-C. idella Val.-has become a very popular fish, being of considerable interest to both rish culturalists and biologists, mainly because of its ability to feed on various plants. Aquatic vegetation is usually poorly utilized and forms a serious obstacle to the efficient management of ponds and lakes. The grass carp is considered an effective remedy for this problem. In addition, the grass carp grows rapidly, and is large and tasty. These biological characteristics have prompted numerous attempts at acclimatization in freshwaters of Europe, Asia and North and South America. Animal food appears to play an impor-America. Animal food appears to play an impor-tant part both in the early and in the later stages of the grass carp's growth and development. The ecological peculiarities of grass carp reproduction under natural conditions, such as in the Amur River (USSR) flood plain, have produced serious difficulties in the grass carp's acclimatization. As a result, investigations have been made on the artificial reproduction and introduction of this species into new environments. Results of investigations of certain aspects of the biology of this fish are presented, which may elucidate the grass carp's role in the productive processes of aquatic ecosystems.—Copyright 1975, Biological Ab-W76-06013

OVERWINTERING OF EVERGREENS IN PLASTIC STRUCTURES,

Michigan State Univ., East Lansing. Agricultural Experiment Station. H. Davidson, and R. Mecklenburg. Hortscience, Vol 9, No 5, p 479-480. 1974. Illus.

Descriptors: *Plastics, *Dehydration. Identifiers: Desiccation, Evergreens, Overwinter-

The overwintering of evergreens without irrigation in plastic structures was best accomplished in a house oriented in a north-south direction and covered with milky polyethylene. Dehydration of covered with mikey polyethylene. Denydration or evergreens in a structure covered with clear polyethylene and oriented in an east-west direction was attributed to high vapor pressure gradients that occurred in clear days. Evergreens gradients that occurred in clear days. Evergreens overwintered in structures covered with clear polyethylene should be inspected periodically and irrigated as necessary to prevent desiccation.—Copyright 1975, Biological Abstracts, Inc. W76-06014

EFFECT OF RUNNING WATER ON THE PREDATORY EFFICIENCY OF THE LARVIVOROUS FISH CAMBUSIA AFFINIS, Bangalore Univ. (India). Dept. of Zoology. S. Ravichandra Reddy, and T. J. Pandian. Oecologia (Berl). 16(3): 253-256. 1974.

Descriptors: *Livebears, *Predation, Running Identifiers: Anopheles-stephansi, Culex-fatigans, Gambusia-affinis, *Larvivorous fish.

Effects of standing and running water on the predatory efficiency of the larvivorous fish Gambusia affinis was tested at 6 different current speed: 0.0, 0.8, 2.4, 4.5, 8.5 and 10.2 ml/sec. G. affinis preyed upon 25 Anopheles stephansi or 21 Culex fatigans (IV instar) during the test period of 10. https://doi.org/10.1001/j.com/10.1001/j. 10 h. The predatory efficiency of G. affinis decreased remarkably to about 60% and thereafter gradually to about 30% in aquaria containing running water at the speed of 2.4 and 10.2 ml/sec, respectively .-- Copyright 1975, Biological Abstracts, Inc. W76-06021

THE FAUNA OF CAREEL BAY WITH COM-MENTS ON THE ECOLOGY OF MANGROVE AND SEA-GRASS COMMUNITIES, Australian Museum, Sydney. Dept. of Marine In-

For primary bibliographic entry see Field 2L. W76-06022

SUBTIDAL MARINE BIOLOGY OF CALIFOR-NIA, WITH EMPHASIS ON THE SOUTH, For primary bibliographic entry see Field 2L. W76-06023

DETECTION AND PRELIMINARY IDENTIFICATION OF ENDOGENOUS ANTITRANS-PIRANTS IN WATER-STRESSED SORGHUM

Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
A. B. Ogunkanmi, A. R. Wellburn, and T. A. Mansfield.

Planta (Berl), 117(4): 293-302, 1974.

Descriptors: *Antitranspirants, *Sorghum, Plant

management, Stomata. Identifiers: Commo Commelina-Communis, stress(Plants).

S. (sudanense) plants that had been subjected to S. (sudanense) piants that had been subjected to different degrees of water stress were examined for the occurrence of endogenous compounds capable of inducing stomatal closure, i.e. 'antitranspirants.' Acidic extracts contained increased amounts of abscisic acid (ABA) as the amount of stress increased, but another highly acamount of stress increased, but another highly ac-tive compound easily distinguished from ABA also accumulated. This compound, also found in neutral extracts, was probably all trans-farnesol, an isoprenoid alcohol which, like ABA, is a sesquiterpenoid. Highly dilute solutions of 'commercial' farnesol induced stomatal closure when applied to isolated epidermis of Commelina (Communis).—Copyright 1975, Biological Abstracts, Inc. W76-06026

Group 21-Water In Plants

IONIC LEAF ACCUMULATION IN GRAPES, GUAVA AND OLIVE PLANTS AS AFFECTED BY THE SALINITY OF IRRIGATION WATER, Alexandria Univ. (Egypt). Faculty of Agriculture. For primary bibliographic entry see Field 3C.

BREEDING PLACES AND SEASONAL IN-CIDENCE OF AEDES AEGYPTI, AS ASSESSED BY THE SINGLE-LARVA SURVEY METHOD, World Health Organization, Dar es Salaam (Tanzania). East African Aedes Research Unit. For primary bibliographic entry see Field 5G. W76-06033

RESPONSE OF SOIL TESTACEA TO SOIL MOISTURE FLUCTUATIONS,
Calgary Univ. (Alberta). Dept. of Biology.
For primary bibliographic entry see Field 2G. W76-06038

SELECTOR SYSTEMS IN RECORDING PHYSIOLOGICAL AND BEHAVIORAL ACTIVITY IN SEDENTARY AQUATIC ANIMALS, Victoria Univ. of Manchester (England). Dept. of Zoology. R. Earll, and D. T. Evans.

J Exp Mar Biol Ecol. 15(1): 35-41. 1974.

Descriptors: *Aquatic animals, *Animal physiology, Sessile algae, Invertebrates, *Animal *Animal gy, Ses behavior.

Identifiers: Aktograph, Bivalves, Recording, *Selector systems

The design and use of selector systems in recording physiological rate functions and behavioral ac-tivity in sessile invertebrates, particularly bivalves, is described for use in the laboratory and the field. The experimental limitations of the technique are discussed and the use of switch systems with other types of aktograph is described. Switch systems permit large groups of animals to be used in activity studies while reduc-ing both time spent in data handling and cost/animal of the recording system.--Copyright 1974, Biological Abstracts, Inc.

THE MICROENVIRONMENT OF CLIMACIUM

AMERICANUM,
Platte Technical Community Coll.. Columbus. Nebr

For primary bibliographic entry see Field 2G. W76-06045

FURTHER OBSERVATIONS ON THE MIGRA-TION OF GAMMARUS ZADDACHISEXTON (CRUSTACEA, AMPHIPODA) IN A FRENCH

Amsterdam Univ. (Netherlands). Inst. of Taxonomic Zoology.
H. G. Dennert, and M. J. Van Marse

Bull Zool Mus Univ Amst. 3(20): 157-167, 1974.

Descriptors: Crustaceans, Ions, Chlorides, Calci-Chlorine, um, Physicochemical properties, Chlorine, Reproduction, Amphipoda, Streams, Mortality, *Migration, Streams. Identifiers: *Gammarus-Zaddachi, *France.

The migration of G. zaddachi in La Slack, a small stream on the French Channel coast and some physico-chemical properties of the river are discussed. In laboratory experiments, the in-fluence of the Cl-and Ca++concentration on the survival-rate and reproduction of G. zaddachi was investigated. A raise in the Cl-concentration of the medium caused a significant improvement of the survival rate. A rise in the Ca++concentration also gives, although not significant, a higher survival rate. -- Copyright 1974, Biological Abstracts, Inc. W76-06046

FOOD HABITS OF THE ROUGH SHINER, NOTROPIS BAILEYI SUTTKUS AND RANEY, IN HALAWAKEE CREEK, ALABAMA, Ichthyological Associates, Inc., Drumore, Pa. D. Mathur, and J. S. Ramsey. Am Midl Nat. 92(1), p 84-93, 1974.

Descriptors: *Alabama, Diptera, *Shivers, *Fish food organisms, *Fish diets, Mayflies, Insects. Identifiers: Halawakee Creek(Ala), Notropis-Baileyi, Trichoptera.

In Halawakee Creek Alabama, the rough shiner, N. baileyi, showed 2 distinct feeding peaks, one during the daylight and the other during the hours of darkness. Immature forms of Diptera, Ephemeroptera, and terrestrial insects were dominant in the diet during the 24-h period. These or-ganisms were also common in the drift samples taken concurrently with the fish. Daily ration varied from 5.9-6.5% of the body weight. Feeding intensity was lowest in winter, highest in spring and summer and moderate in autumn. Fish less than 35 mm fork length fed on dipteran larvae, terrestrial insects and detritus throughout the year. The diet of the larger fish (>35 mm) was dominated by terrestrial insects, ephemeropteran nymphs, trichopteran larvae and detritus. The diet of the larger fish was more diverse than that of the smaller individuals. The opportunistic feeding habits are in part responsible for the success of this introduced species in Halawakee Creek .--Copyright 1974, Biological Abstracts, Inc. W76-06126

NOTES ON THE PRODUCTION OF STREAM BRYOPHYTES IN THE HIGH PYRENEES (FRANCE),

Freshwater Biological Association, Wareham (England). River Lab. F H Dawson

Ann Limnol, 9(3), p 231-240, 1973.

Descriptors: *Productivity, Estimating, *Standing crops.

Identifiers: *Bryophytes, Cratoneuron-Commutatum, Fissidens, *Fontinalis-Squamosa, *France(Pyrenees region), Waterfalls.

A production estimate for Fontinalis squamosa of 92 gm m-2 is a minimum one, assuming an annual branching pattern. Standing crops for the total stream area of bryophytes of 325 gm m-2 for the site at Artigusse and of 92 gm m-2 for the Estaragne tributary were recorded. The area covered was high in the former and very low in the latter (only 7%). The maximum recorded standing crops were 1960 gm m-2 for Cratoneuron commutatum and 682 gm m-2 for Fontinalis and Fissidens combined. The splash zone around a small water-fall is described.--Copyright 1974, Biological Ab-W76-06129

THE EFFECTS OF SIZE-SELECTION PREDA-TION AND ENVIRONMENTAL VARIATION ON THE DISTRIBUTION AND ABUNDANCE OF A CHIRONOMID, PARABORNIELLA TONNOIRI

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia), Div. of Entomology. R. E. Jones

Aust J Zool. 22(1), p 71-89, 1974.

Descriptors: *Predation, *Diptera, *Distribution, Australia, Breeding, Larvae, Vegetation, Ponds, Environmental effects.

Identifiers: Allotrissocladius-Sp, Paraborniella-

Larvae of the Australian chironomid P. tonnoiri live in temporary rainpools and aestivate in the dry mud during the summer drought. Over most of their range, they are restricted to large, deep, vegetated pools. A number of factors influence population numbers, but the most critical in deterpopulation lambers, out the most critical in deter-mining the species' distribution is the presence of another chironomid, Allotrissocladius sp. Fourth-instar Allotrissocladius larvae kill P. tonnoiri when the latter are in 1st and possible 2nd instar. The deep, vegetated pools have ample food available when P. tonnoiri breeds, so young larvae grow rapidly through their early in stars and soon cease rapidly through their early in stars and soon ceases to be vulnerable. In shallower, non-vegetated pools, with much less food, the larvae grow more slowly, are vulnerable for longer, and are con-sequently eliminated. P. tonnoir is also absent from areas where low temperatures during early life may slow its growth and it seems likely that the same mechanism is responsible. It may seldom be enough to known about the gross structure and physical characteristics of an ecosystem in order to predict whether or not a species will persist in it--it is also necessary to know some of the details of when and how it interacts with others.--Copyright 1974, Biological Abstracts, Inc.

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PLANT DEVELOPMENT UNDER SNOW, Wisconsin Univ., Madison. Dept. of Agronomy. S. L. Kimball, and F. B. Salisbury. Bot Gaz. 135(2) p 147-149, 1974.

Descriptors: *Snow cover, *Plant physiology, *Growth rates, *Growth stages, Temperature. Identifiers: Brodiaea-Douglassii, Claytonia-Lan-Nemophilaceolata. Lithophragma-Glabra, Breviflora.

The growth and development of 5 montane species (Brodiaea douglassii, Claytonia lanceolata, Lithophragma glabra, Nemophila breviflora, Orogenia linearifolia) were observed under snow cover. Various stages of leaf, shoot and flower development occurred in the different species while under snow cover and at temperatures near 0 C.--Copyright 1974, Biological Abstracts, Inc. W76-06147

2J. Erosion and Sedimentation

UNDERWATER WALL STRUCTURE. For primary bibliographic entry see Field 8A. W76-05523

TRACE ELEMENT, MINERALOGY, AND SIZE DISTRIBUTION OF SUSPENDED MATERIAL SAMPLES FROM SELECTED RIVERS IN EASTERN KANSAS,

Kansas Univ., Lawrence. Dept. of Geology. For primary bibliographic entry see Field 5B. W76-05606

RESERVOIR SEDIMENTATION ASSOCIATED WITH CATCHMENT ATTRIBUTES, LAND-SLIDE POTENTIAL, GEOLOGIC FAULTS, AND SOIL CHARACTERISTICS, Forest Service (USDA), Berkeley, Calif., Pacific

Southwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D. W76-05617

GUIDELINES FOR CHARACTERIZING NATURALLY UNSTABLE OR POTENTIALLY UNSTABLE SLOPES ON WESTERN NATIONAL

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D. W76-05621

A STOCHASTIC MODEL OF DISPERSION OF SEDIMENT PARTICLES RELEASED FROM A CONTINUOUS SOURCE,

Montreal Univ. (Quebec). Dept. of Mathematics.

14

Water Resources Research, Vol. 11, N.6, p 919-925. December 1975, 4 fig. 14 ref.

Descriptors: *Dispersion, *Stochastic processes, *Sediment transport, *Sediment discharge, *Sediment distribution, *Distribution patterns, Flow, Flow profiles, Sediments, Bed load, Suspended solids, Suspended load, Sediment load, Convection, Movement, Water pollution, Water pollution sources, *Path of pollutants, Mathemati-cal studies, Statistical models. Identifiers: *Random entry model.

The process of dispersion of bed sediment in streams has become a target for study because sediment may act as both a pollutant and a vehicle for soluble pollutants. Previous mathematical models of longitudinal dispersion of bed sediment described the behavior of a quantity of particles released simultaneously from a point or line source. The proposed model described the more common case of longitudinal dispersion of a quantity of sediment released gradually, at a known rate, during a specified time interval. Cases were examined for continuous release throughout finite and open-ended time intervals. Provided that certain regularity conditions hold, dispersion models may be obtained for both cases by simple integral transformation of the model for instantaneous release. (Bender - ISWS) W76-05663

A STABLE NUMERICAL MODEL FOR LOCAL SCOUR.

Windsor Univ. (Ontario). Dept. of Civil Engineer-

N. A. Zaghloul, and J. A. McCorquodale.

Journal of Hydraulic Research, Vol. 13, No. 4, p. 425-444, December 1975. 13 fig, 14 ref.

Descriptors: *Scour, *Erosion, Numerical analysis, Flumes, Turbulence, Turbulent flow, Hydraulics, Sediment transport, Open channel flow, Model studies, Velocity, Groins(Structures), Mathematical models. Identifiers: *Local scour, Flume experiments,

Scouring processes, Local velocity.

A numerical model for local scour was developed and confirmed by several flume experiments. The model involved two relaxation stages: (1) two dimensional relaxation in time, (2) relaxation of the depth, i.e., the third dimension. The first stage utilized the Helmholtz-Poisson form of the Revnolds equations with constant eddy viscosity and proceeded until a stable separation pattern obtained. The second stage permitted the depth to change in such a way as to balance ap-plied shear and the bed resistance. At this stage the stream functions and vorticities are relaxed in space only. A stability analysis of the numerical model was completed. This model predicted both the depth and shape of the scour hole. The following conclusions were derived: (1) The proposed numerical model predicts both the depth and the shape of the scour hole and is in good agreement with the experimental results. It was found that the vorticity, local velocity, and turbulence are the main causes of erosion. (2) The alternating direction implicit scheme used with central time differencing has the advantage of averaging the errors between successive time advancements and was proven to be stable for appropriate boundary conditions. (3) The finite difference formulation presented for the depth averaged stream function ensures the stability of the solution. (Lee-ISWS) W76-05666

DEVELOPMENT OF OXYGEN DEFICITS IN 14 SOUTHERN ONTARIO LAKES,

Trent Univ., Peterborough (Ontario). Dept. of Biology.

For primary bibliographic entry see Field 5C. W76-05679

FALLOUT CS-137: A TOOL IN CONSERVA- C. E. Simmons. TION RESEARCH.

Agricultural Research Service, Oxford, Miss.
J. C. Ritchie, and J. R. McHenry.
Journal of Soil and Water Conservation, Vol. 30,

No. 6, p 283-286, November-December 1975. 3 fig,

Descriptors: *Fallout. *Sedimentation rates. *Soil Descriptors: "Fallout, "Sedimentation rates, "Soil conservation, "Erosion control, "Sedimentation, Cesium, "Mississippi, Sediment transport, Silting, Erosion, Analytical techniques, Sediment discharge, Radioactivity, Water pollution sources, Radiochemical analysis, Water quality, Soil analysis, Reservoir silting, Topsoil, Soil erosion, Changles Flood plains

nels, Flood plains.

Identifiers: *Cesium-137, *Silting rates, Erosion cycle, Soil particles, Radioactive elements, Nuclear weapons, Radioactive tag.

Fallout from tests of nuclear weapons provides a unique tag for use in studies of the erosion cycle. Fallout cesium-137 (Cs-137) is tightly adsorbed on soil particles. Its movement within watersheds in predominantly associated with soil materials. These studies showed that the Cs-137 loss from watersheds correlates logarithmically with soil loss, as calculated by the universal soil loss equation and measured from small runoff plots. The distribution of Cs-137 in vertical profiles of sedi-ment deposited in impoundments or floodplains can be correlated with yearly atmospheric fallout rates. It is therefore possible to estimate the sedi-ment deposition rates from 1962 or 1958 to the present. This technique can be used to determine sedimentation rates in impoundments or flood-plains for which other records are unavailable. (Henley - ISWS) W76-05690

EQUATIONS FOR RESISTANCE TO FLOW AND SEDIMENT TRANSPORT IN ALLUVIAL CHANNELS.

Geological Survey, Reston, Va.

T. Maddock, Jr. Water Resources Research, Vol 12, No 1, p 11-21, February 1976. 8 fig 4 tab, 35 ref.

Descriptors: *Equations, *Sediment transport, *Flow resistance, *Alluvial channels, Channel morphology, Flumes, Discharge(Water), morphology, Methodology, Evaluation.

(1) In a flume of constant width if discharges of water and sediment are introduced independently. mean velocity, mean depth, and slope dependent variables. (2) In a flume of constant width operated at constant depth and recirculating a mixture of water and sediment, the unit discharge of water and the depth are independent variables, while the sediment concentration, the slope, and the mean velocity are dependent variables. The the mean velocity are dependent variables. The two equations required for the solution of cases 1 and 2 are a resistance equation and a sediment transport equation. This paper presents these two relationships, to show that most previously proposed relationships contain within the formulation presented here, and to demonstrate that this formulation is superior to others in predicting the response of alluvial channel systems to changes in temperature. (Woodard-USGS) W76-05844

LATE PLEISTOCENE AND HOLOCENE DEPOSITIONAL TRENDS, PROCESSES, AND HISTORY OF ASTORIA DEEP-SEA FAN, NORTHEAST PACIFIC,

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 2L. W76-05845

SEDIMENT CHARACTERISTICS OF STREAMS IN THE EASTERN PIEDMONT AND WESTERN COASTAL PLAIN REGIONS OF NORTH CAROLINA.

Geological Survey, Raleigh, N.C.

Available from Supt. of Documents, GPO, Wash., DC 20402, Price \$1.40. Water-Supply Paper 1798-0, 1976. 32 p, 9 fig, 5 tab, 14 ref.

Descriptors: *Sediment transport. *Sediment yield, *Sediment distribution, *North Carolina, Streamflow, *Coastal plains, Slopes, Topography, Land use, Runoff, Storms, Reservoirs, Sediment discharge, Sedimentation rates, Data collections, Sampling, Suspended solids, Particle size. Identifiers: *Piedmont region(NC).

The sediment-transport characteristics of streams were determined in a 6,000-square-mile area of the Coastal Plain and Piedmont regions of eastern North Carolina during 1969-73. The study covered all or parts of 21 counties and included data for 28 sediment-sampling stations located in parts of 4 major river basins, the Roanoke, Pamlico, Neuse, and Cape Fear. Annual suspended-sediment yields ranged from 333 to 12 tons per square mile. Streams in the Piedmont region have the highest yields. Suspended-sediment yield decreases in an eastward direction from the Piedmont to the Coastal Plain region. Sediment characteristics are directly affected by topography, storm runoff, geology, land use, and manmade detention structures. At one sampling station in the 1973 water year, 44 percent of the suspended sediment tonnage was transported during 34 days of high flow. In the Piedmont region, sediment yields vary indirectly with the percentage of forest cover in the basin, but there appears to be no definite relationship between forest cover and yield in the Coastal Plain region. Large lakes act as sediment-detention reservoirs. Average annual sediment yields ranged from 98 to 333 tons per square mile for 3 headwater streams which flow into Hyco Lake in Person County; however, the yield for the station less than 2 miles downstream from Hyco Dam was about 12 tons per square mile. Most suspended sediment during floods in Piedmont streams ranges in size from sand to silt, whereas the suspended material in flooding streams in the Coastal Plain is generally clay size. (Woodard-W76-05849

SEDIMENT CHARACTERISTICS OF FIVE STREAMS NEAR HARRISBURG, PENNSYL-VANIA, BEFORE HIGHWAY CONSTRUCTION, Geological Survey, Harrisburg, Pa.

For primary bibliographic entry see Field 4C. W76-05854

THE 1973 MISSISSIPPI RIVER BASIN FLOOD: COMPILATION AND ANALYSES METEOROLOGIC, STREAMFLOW, AND SEDI-MENT DATA.

National Weather Service, Silver Spring, Md.; and Geological Survey, Reston, Va. For primary bibliographic entry see Field 2E. W76-05860

ROLE OF COPEPOD FECAL PELLETS IN THE VERTICAL TRANSPORT OF FRESHWATER DIATOMS.

Argonne National Lab., Ill. Radioological and Environmental Research Div. For primary bibliographic entry see Field 5C. W76-05880

VERTICAL TRANSPORT OF PARTICULATE MATERIAL IN LAKE MICHIGAN BY THE LORICA OF CODONELLA CRATERA,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5C. W76-05881

Group 2J-Erosion and Sedimentation

DISTRIBUTION OF DIATOM FRUSTULES IN LAKE MICHIGAN SEDIMENT CORES, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.
For primary bibliographic entry see Field 5C.

DISTRIBUTION OF AMORPHOUS, DIATOM FRUSTULE, AND DISSOLVED SILICA IN A LEAD-210 DATED CORE FROM SOUTHERN

LAKE MICHIGAN, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.
For primary bibliographic entry see Field 5C. W76-05883

STABLE LEAD GEOCHRONOLOGY OF FINE. GRAINED SEDIMENTS IN SOUTHERN LAKE

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05884

GEOCHRONOLOGY OF LAKE MICHIGAN SEDIMENTS: ANOMALIES IN LEAD-210 DIS-TRIBUTIONS.

Michigan Univ., Ann Arbor. For primary bibliographic entry see Field 5B. W76-05885

SEDIMENTARY PU-239, PU-240 PHASE DISTRIBUTIONS IN LAKE MICHIGAN SEDI-

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05891

THE DISTRIBUTION OF PLUTONIUM IN LAKE MICHIGAN SEDIMENTS,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div For primary bibliographic entry see Field 5B. W76-05892

FACTORS INFLUENCING INFILTRATION AND SEDIMENT PRODUCTION OF SEMIARID RANGELANDS IN NEVADA,

Texas A and M Univ., College Station. Dept. of Range Science. For primary bibliographic entry see Field 2G. W76-05912

HYDRAULIC COMPUTATION OF A POOL HOLLOW.

For primary bibliographic entry see Field 2E. W76-05931

SLOPE STABILITY PROBLEMS ASSOCIATED WITH TIMBER HARVESTING IN MOUNTAINOUS REGIONS OF THE WESTERN UNITED STATES, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary Libliographic entry see Field 4C.

INTERPRETING STABILITY PROBLEMS FOR

THE LAND MANAGER,
Forest Service (USDA), Corvallis, Oreg. Pacific
Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D. W76-05947

THE FOREST ECOSYSTEM OF SOUTHEAST ALASKA 5. SOIL MASS MOVEMENT, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station.

For primary bibliographic entry see Field 4D. W76-05950

NEMATODES OF LAKE BALATON: SEASONAL QUALITATIVE AND QUANTITA-

TIVE CHANGES,
Research Inst. for Water Resources Development. Budapest (Hungary). Water Quality and Technology Dept. For primary bibliographic entry see Field 5C.

W76-06004

MERCURY IN SEDIMENTS OF THE HORWER BUCHT (LAKE LUCERNE) AND TRIBUTARY STREAMS, SWITZERLAND,
Hobart and William Smith Coll., Geneva, N. Y.

Dept. of Chemistry. For primary bibliographic entry see Field 5A. W76-06136

MERCURY OCCURRENCE IN SEDIMENT CORES FROM WESTERN LAKE ERIE. Bowling Green State Univ., Bowling Green, Ohio. Dept. of Geology.
For primary bibliographic entry see Field 5B. W76-06137

APPLICATION OF INFRARED SPECTROSCO-PY TO ERODIBILITY STUDIES OF THE SOIL, Allahabad Univ. (India). Dept. of Chemistry. S. Chandra, and S. K. De. J Indian Chem Soc. 50(8), p 523-527, 1973.

Descriptors: *Soil erosion, Spectroscopy, Infrared radiation, Analytical techniques, Arid lands, Asia. Identifiers: *India(Uttar Pradesh)

The IR-absorption spectra of uneroded and eroded soils of semi-desert, arid, semi-arid, subhumid, Vindhyan and Bundelkhand soil-climatic regions of Uttar Pradesh, India, were taken by KBr-Mull technique on Perkin-Elmer IR spectrophotometer. This technique was useful in characterizing eroded and uncroded soils and also in differentiating more erodible soils from erosion resistant ones .-- Copyright 1974, Biological Abdtracts, Inc. W76-06140

2K. Chemical Processes

EVALUATION USING DEPOSI-TIONAL SYSTEMS: AN EXAMPLE IN NORTH-CENTRAL TEXAS,

Dames and Moore, Boca Raton, Fla For primary bibliographic entry see Field 2F. W76-05554

AUTOMATED DILUTION FOR MEASURE-MENT OF NITRATE IN WATER, Canada Centre for Inland Waters, Burlington

For primary bibliographic entry see Field 5A. W76-05594

VERTICAL DISTRIBUTION OF NITRATE CON-CENTRATION IN INTERSTITIAL WATER OF MARINE SEDIMENTS WITH NITRIFICATION AND DENITRIFICATION.

Brussels Univ. (Belgium). Industrial Chemistry Inst For primary bibliographic entry see Field 5B.

NATURE AND STABILITY OF COMPLEX MERCURY COMPOUNDS IN SURFACE AND GROUND WATERS, PHASE II,

Auburn Univ., Ala. Dept. of Chemistry For primary bibliographic entry see Field 5A. W76-05838

W76-05678

LIMNOLOGICAL DATA FOR THE MAJOR STREAMS IN CHESTER COUNTY, PENNSYLVANIA,

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Geological Survey, Harrisburg, Pa. For primary bibliographic entry see Field 7C. W76-05852

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS COAL REGION OF EASTERN MONTANA, 1975-76, Geological Survey, Helena, Mont.

For primary bibliographic entry see Field 7C. W76-05853

HYDROGEOCHEMICAL DATA FROM IN-VESTIGATION OF WATER QUALITY IN SEWERED AND UNSEWERED AREAS, SEWERED AND SOUTHERN NAS NASSAU COUNTY. LONG ISLAND, NEW YORK,

Geological Survey, Mineola, N.Y. For primary bibliographic entry see Field 7C. W76-05858

NUCLEAR TECHNIQUES IN HYDROLOGY-CURRENT STATUS AND PROSPECTIVE USES. National Academy of Sciences, Washington, D.C.; National Committee for the International Hydrological Decade, Washington, D.C. For primary bibliographic entry see Field 5A. W76-05922

THE DEPOSITION OF MOLYBDENUM IN ANOXIC WATERS,

Scripps Inst. Oceanogr., La Jolla, Calif. Scripps Institution of Oceanography, La Jolla, Calif. K. K. Bertine Mar Chem. 1(1): 43-53. Illus. 1972.

Descriptors: *Molybdenum, Anaerobic conditions, Water chemistry, Chemical reactions, Sediment, Sulfate, Bacteria. Identifiers: Anoxic.

Mo deposition in anaerobic areas is a result of several processes. The primary one, which removes about 70% of the Mo in laboratory experiments, is the coprecipitation with iron sulfide on a relatively short time scale (a week after the hydrogen sulfide has built up). The formation of Mo(V) by any of the following mechanisms: reduction by organic acids, reduction of Mo in the N cycle or by sulfate-reducing bacteria, all result in a slow sorption or coprecipitation of about 20% of the total Mo after a 3-wk period onto almost any solid phase present. If the pH in the anoxic sediment decreases, this process becomes increasingly important. The total removal of Mo at any site is the sum of these processes.--Copyright 1975, Biological Abstracts, Inc. W76-05996

MOLYBDENUM IN A NEARSHORE AND ESTUARINE ENVIRONMENT, NORTH WALES. Southampton Univ. (England). Dept. of Oceanography G. B. Jones

Estuarine Coastal Mar Sci. 2(2): 185-189, 1974.

Descriptors: *Molybdenum, *Estuarine environment, Coasts, Sea water, Salinity, Sediment. Identifiers: Wales(UK).

Determinations of Mo were made on estuarine and nearshore surface sea water and sediments col-lected off the North Wales coast (United Kingdom). The average ratio of concentration of Mo (ug/l) to salinity (ppt) for the nearshore region was in good agreement with other work on this element for this region. Although dilution with fresh water was the major factor influencing the concentration of Mo in the estuary, higher values of Mo in the estuary, higher values of Mo were detected at

some intermediate salinities. This increase in Mo concentration could be due to desorption of particulate material during mixing. The relationship between organic material, pH and the Mo content of an anoxic sediment was studied on 2 cores obtained, at different seasons, from the same point of a mud flat of the Menai Straits. The results show a significant increase in Mo and organic material for the core collected in Feb., compared to that in Aug., and close correlation between their concentrations. This type of environment could represent an important temporary removal site for the element.—Copyright 1975, Biological Ab-W76-06000

DETERMINATION OF SELENIUM IN NATU-RAL WATERS USING THE CENTRIFUGAL PHOTOMETRIC ANALYZER,

J. L. Bowling, J. A. Dean, and G. Goldstein. Anal Lett. 7(3), p 205-213, 1974.

Descriptors: *Analytical techniques, Water analysis, *Ion exchange, Separation techniques, *Photometry, Pollutant identification, Centrifuga-Identifiers: *Selenium

A rapid ion exchange separation converts the methylene blue spot test for Se into a selective and sensitive method for quantitative determination of sensitive network of quantitative determination of the trace quantities of Se. Increased speed, accuracy, and reproducibility is achieved because of the parallel analysis technique of the centrifugal photometric analyzer. Natural (stream and lake) water samples, spiked with 0.10-0.5 microgram of Se, were analyzed with an average accuracy of 4.2% after removal of interferences by ion exchange.—Copyright 1974, Biological Abstracts, W76-06128

2L. Estuaries

FLOOD PLAIN INFORMATION: COASTAL AREAS, LEVY COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Florida For primary bibliographic entry see Field 4A. W76-05647

VERTICAL DISTRIBUTION OF NITRATE CON-CENTRATION IN INTERSTITIAL WATER OF MARINE SEDIMENTS WITH NITRIFICATION AND DENITRIFICATION,

Brussels Univ. (Belgium). Industrial Chemistry

For primary bibliographic entry see Field 5B. W76-05678

A SPECTRAL LIGHT ABSORPTION METER FOR MEASUREMENTS IN THE SEA, Copenhagen Univ., Denmark. Inst. of Physical

Oceanography

For primary bibliographic entry see Field 7B. W76-05680

DATE PLEISTOCENE AND HOLOCENE DEPOSITIONAL TRENDS, PROCESSES, AND HISTORY OF ASTORIA DEEP-SEA FAN, NORTHEAST PACIFIC, Coological Survey.

Geological Survey, Menlo Park, Calif. H. Nelson.

Marine Geology, Vol 20, No 2, p 129-173, February 1976. 12 fig, 5 tab, 109 ref.

Descriptors: *Sediment transport, *Columbia River, *Pacific Ocean, *Alluvial fan, *Oregon, Sediment discharge, Sediment distribution, Sedimentation, Sediment yield, Turbidity currents, Particle size, Sedimentary petrology, Pleistocene epoch. Identifiers: *Holocene epoch.

Astoria Fan occupies approximately 20,000 sq km of the deep-sea floor off northern Oregon. The fan radiates asymmetrically southward from the mouth of Astoria Canyon which heads off the Columbia River. In the Late Pleistocene, turbidity currents funneled most coarse-grained debris through upper channels to depositional sites in middle and lower fan distributaries that periodically shifted, anastomosed and braided to spread sand layers throughout the area. At this time, depositional rates were many times greater (50 cm/1000 years) than in the Holocene (8 cm/1000 years). By the Late Holocene, continuous particle-by-particle deposition of hemipelagic clay with a biogenous coarse fraction was the predominant process on the fan. These hemipelagites contain progressively more clay size and less terrigenous debris offshore, and are finer grained, richer in planktonic tests and dominated by radiolarians compared to the foraminiferal-rich Pleistocene clays. The hemipelagic sedimentation of intergla-cial times, however, is insignificant compared to turbidite deposition of glacial times. (Woodard-HSGS) W76-05845

SEDIMENT CHARACTERISTICS OF STREAMS IN THE EASTERN PIEDMONT AND WESTERN COASTAL PLAIN REGIONS OF NORTH

Geological Survey, Raleigh, N.C. For primary bibliographic entry see Field 2J.

CONDITIONAL EXPECTED TSUNAMI INUN-DATION FOR HAWAII,

Hawaii Univ., Honolulu. For primary bibliographic entry see Field 8B. W76-05920

ESTIMATE OF THE RATE OF TURBULENT MIXING OF THE FLUID IN WIND-DRIVEN CURRENTS FROM THE RESULTS OF MOV-ING AND STILL PARTICLE PHOTOGRAPHY, For primary bibliographic entry see Field 8B. W76-05932

MIREX RESIDUES IN SELECTED ESTUARIES OF SOUTH CAROLINA: JUNE 1972, Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab. For primary bibliographic entry see Field 5A. W76-05954

THE DEPOSITION OF MOLYBDENUM IN ANOXIC WATERS,

Scripps Inst. Oceanogr., La Jolla, Calif. Scripps Institution of Oceanography, La Jolla, Calif. For primary bibliographic entry see Field 2K. W76-05996

MOLYBDENUM IN A NEARSHORE AND ESTUARINE ENVIRONMENT, NORTH WALES. Southampton Univ. (England). Dept. of Oceanog-

For primary bibliographic entry see Field 2K. W76-06000

DISTRIBUTION AND STRUCTURE OF BENTHIC ASSEMBLAGES IN PUGET SOUND, WASHINGTON, USA,

United Nations Educational, Scientific, and Cultural Organization, Paris (France). For primary bibliographic entry see Field 5B. W76-06015

CHANGES IN THE LIMNOLOGICAL FEA-TURES OF A MEROMICTIC LAKE SUIGETSU DURING THE YEARS, 1926-1967, Nagoya Univ. (Japan). Water Research Lab.

For primary bibliographic entry see Field 2H.

W76-06018

vertebrates

THE FAUNA OF CAREEL BAY WITH COM-MENTS ON THE ECOLOGY OF MANGROVE AND SEA-GRASS COMMUNITIES. Australian Museum, Sydney. Dept. of Marine In-

P. A. Hutchings, and H. F. Recher. Aust Zool. 18(2): 99-128, 1974.

Descriptors: *Australia, Bays, Detritus, Ecology, Salt marshes, *Mangrove swamps.
Identifiers: *Careel Bay(Australia), Posidonia, *Sea-grass, Zostera.

Careel Bay, Pittwater, New South Wales can be divided into 5 zones, salt marsh, mangroves, Zostera and Posidonia weed beds and sandy beach. The flora and fauna of each of these zones are described with comments on the seasonal abundance of animals in the weed beds and on the sandy beach. Finally the inter-relationship of these zones to each other, especially in relation to the detritus food chain, is discussed.--Copyright 1975, Biological Abstracts, Inc. W76-06022

SUBTIDAL MARINE BIOLOGY OF CALIFOR-NIA, WITH EMPHASIS ON THE SOUTH,

R. Galbraith, and T. Boehler. Naturegraph Publishers; Healdsburg, Calif., 1974. 128 p, \$3.95.

Descriptors: *California, *Marine biology, Tidal waters, Publications, Marine fish, Marine plants, Marine animals. Plankton.

Marine plants and animals located in the near shore waters of California and around the offshore islands of California are described in this book which is intended as a guide and reference for students of marine life and divers. The book is also designed to serve as a bridge between the studentdivers observations and technical publications on marine biology. The characteristics of sharks and rays are discussed. Practical information is given for divers encountering a shark. Species of bony fishes are identified and described and keys to their identification are included. Representative their identification are included. Representative forms of invertebrate groups are also detailed. Species of marine, plankton, plants and mammals are described. The study of marine ecology, fish and game regulations, preservation of the marine environment, oil, thermal and waste pollution in the marine environment and pesticide concentrations were discussed. A bibliography and index are provided. Numerous line drawings and photographs illustrate the text.--Copyright 1975, Biological Abstracts, Inc. W76-06023

TRACE METALS IN THE WATERS OF THE GULF OF ST. LAWRENCE,

Bedford Inst., Dartmouth (Nova Scotia). Atlantic For primary bibliographic entry see Field 5A. W76-06024

EPIZOOTIOLOGY OF MINCHINIA NELSONI IN SUSCEPTIBLE WILD OYSTERS IN VIR-GINIA, 1959 TO 1971,

Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 5C. W76-06035

SPATIAL DISPERSION OF AN ESTUARINE BENTHIC FAUNAL COMMUNITY,

Swedish Water and Air Pollution Research Lab., Goteborg. R. Rosenberg.

J Exp Mar Biol Ecol. 15(1): 69-80. 1974.

Descriptors: *Benth fauna, *Dispersion, *Spatial distribution, Sediments, Estuarine environment.

Group 2L—Estuaries

By means of a box-sampler 20 moderately undisturbed sediment samples were obtained, which were subsampled on board the ship. The fauna in the upper 0-5 cm of the sediments was compared to that in the 5-10 cm layer; almost all species collected in both strata were found in the upper 0-5 cm. About 64% of the individuals and 74% of the biomass were restricted to this upper layer. A sample area of 0.5 m2 (depth 0-10 cm) was sufficient to make a quantitative evaluation of the benthic community. The horizontal dispersion of the macrobenthic community was studied using the variance/mean ratio and its dependence on sample size is discussed. The abundant species oc-curred in patches large than 0.06 m2 and high densities were correlated with aggregation .-- Copyright 1974, Biological Abstracts, Inc.

FOOD OF TARAKIHI IN WESTERN BAY OF PLENTY AND TASMAN BAY, NEW ZEALAND, Public Service Electric and Gas Co., Newark, N. J. Research and Development Dept. B. L. Godfriaux.

N Z J Mar Freshwater Res. 8(1): 111-153, 1974 Bays. Crustaceans.

Mollusks Descriptors: Polychaetes, Teleosts, Aquatic animals, Fish food

Identifiers: *Cheilodactylus-Macropterus, Echinoderm, *New Zealand, *Tarakihi, Western Bay of Plenty(NZ), Tasman Bay(NZ).

Feeding was examined in 1574 tarakihi, Cheilodac-tylus macropterus (Bloch and Schneider) (Teleostei: Cheilodactylidae). Occurrence, points (bulk and numbers methods of gut content analysis were used throughout the study. By all three methods of analysis, polychaetes, crustaceans, echinoderms and mollusks (in that order) generally formed the main food groups. Crustaceans dominated the food of tarakihi (15 cm in fork length, and polychaetes were the dominant food group in specimens) 15 cm. Length of specimen, sampling depth and area, geographical region and time of day affected the occurrence, volume and numbers of food items in the gut, but sex and season did not. Male tarakihi frequented deeper water than females; this result was significant at the (0.001 level.--Copyright 1974, Biological Ab-W76-06047

THE WASHINGTON SHORELINE MANAGE-MENT ACT.

For primary bibliographic entry see Field 5G. W76-06056

COASTAL ZONE MANAGEMENT AND INTER-GOVERNMENTAL COORDINATION,

Louisiana State Univ., Baton Rouge. Law School. For primary bibliographic entry see Field 6E.

COASTAL ZONE MANAGEMENT PROGRAM DEVELOPMENT GRANT.

National Oceanic and Atmospheric Administra-tion, Washington, D.C.
For primary bibliographic entry see Field 6E. W76-06095

MICROORGANISMS AND SULPHIDE IN A POLLUTED ESTUARY. Canterbury Univ., Christchurch (New Zealand). Dept. of Botany

For primary bibliographic entry see Field 5C. W76-06121

THE ECOLOGY OF MORRUMBENE ESTUA-RY, MOZAMBIQUE, Cape Town Univ. (South Africa). Trans R Soc S Afr. 41(1), p 43-97, 1974.

Descriptors: Ecology, Estuaries, Africa, Estuarine environment, Mangrove swamps, Invertebrates, Fish, Productivity, Seasonal, Crabs. Identifiers: *Morrumbene estuary(Mozambique).

Morrumbene is a tropical estuary which opens into Inhambane Bay at 23S on the coast of Mozambique. It is 193 km2 in area and 20 km long with well-developed mangrove swamps draining into a broad lagoon. Temperature, Salinity and substrate conditions are described and it is shown that water temperatures in the upper reaches vary from 18.8C in winter to 28.2C in summer. The vegetation is described briefly. The fauna was sampled by dredging, netting and intertidal transects along the estuary. It is very diverse. An annotated list shows the distribution of 404 macroinvertebrates and 114 spp. of fish. The estuary is not highly productive. The bulk of the fauna is confined to the lagoon and the mangrove swamps in the upper reaches have a restricted and monotonous fauna. All shores are dominated by crabs. Vertical distribution on the shore is controlled by many factors and the depth of the water-table and shade appear to be more imof the water-table and shade appear to be more important than tidal level. The fauna includes 70% tropical species, 13% subtropical endemics and 6% Cape endemics. The estuarine fauna of Morrumbene has only 15% similarity to the fauna of the sheltered seashores of Inhaca Island 400 km to the south. The Morrumbene fauna is much richer in species than all the estuaries in Natal or the southern Cape; it is times richer than Natal or the southern Cape; it is 6 times richer than all the estuaries on the cold Atlantic coast. At the mouths of Atlantic coast estuaries there is a marked temperature barrier in summer and it is suggested that this may limit the estuarine fauna .--Copyright 1974, Biological Abstracts, Inc. W76-06127

EFFECTS OF A TROPICAL CYCLONE ON LITTORAL AND SUB-LITTORAL BIOTIC COMMUNITIES AND ON A POPULATION OF DUGONGS (DUGONG DUGON (MULLER)),
James Cook Univ., of North Queensland, Townsville (Australia). G. E. Heinsohn, and A. V. Spain.

Descriptors: *Australia, *Littoral, *Cyclones, *Mangrove swamps, Algae, Biota, Biological communities, Phaeophyta, Aquatic animals.
Identifiers: Dugong-Dugon, *Dugongs,
*Mangroves, Queensland, Seagrass, *Tropical cyclones.

Biol Conserv. 6(2), p 143-152, 1974.

The extensive damage to littoral and sub-littoral biotic communities caused by cyclone 'Althea', which crossed the tropical coast of Queensland (Australia) on 24 Dec. 1971, are described. The effects of high wind speeds (mean 129.7 km/h), turbulent seas, storm surges and heavy rainfall on mangrove, sea grass, algal and coral reef commu-nities are discussed. Mangroves withstood the im-mediate effects of the cyclone and protected coastal areas. However, long-term effects on mangroves are apparent. Severe wave action, shifting sand, and low salinities caused extensive damage to sea grass, algal and coral reef communities. The effects of the cyclone on a dugong population are described. The catches of dugongs in shark nets set off Townsville increased from an average of 12.7/yr before the cyclone to 41 in 1972 (the yr following the cyclone). This increase is attributed to increased movements in search of food, following extensive damage to sea grass beds. Associated with increased movements, a change in diet oc-curred whereby large amounts of brown algae were eaten in addition to sea grasses. Sex and size (age) distributions of captured dugongs are given and their possible significance discussed.--Copy-right 1974, Biological Abstracts, Inc. W76-06131

DIFFERENTIAL RESPONSES TO DROUGHT IN TWO SPECIES OF FUNDULUS, Miami Univ., Coral Gables, Fla. Dept. of Biology.

For primary bibliographic entry see Field 2H. W76-06132

ON THE BIOLOGY OF SOME ESTUARINE BIVALVES. Port Elizabeth Univ. (South Africa). Dept. of ar hy Ti bo

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Zoology. A. McLachlan. Zool Afr. 9(1), p 15-34, 1974.

Descriptors: Africa, Estuaries, *Estuarine environment, *Growth rates, Seasonal, Aging(Biological), Biological communities. Identifiers: *Bivalves, Dosinia-Hepatica, Eumarcia-Paupercula, Macoma-Litoralis, Psammotel-lina-Capensis, Solen-Capensis, Solen-Corneus, *Swartkops estuary(South Africa).

Studies on bivalves (Dosinia hepatica, Macoma litoralis, Solen corneus, S. capensis, Psammotellina capensis, Eumarcia paupercula in the Swartkops estuary (South Africa) have indicated that spatfall occurs during late summer. After adult popula-tions had been decimated by floods in 1971 spat made up a large proportion of the bivalve popula-tion in 1973. Growth rates vary at different intertidal levels and in different parts of the estuary and growth varies seasonally. In 2 spp. age determinations from growth rings corresponded well with age determinations from size frequency histograms.—Copyright 1974, Biological Abstracts, Inc. W76-06134

THE COMBINED EFFECTS OF HIGH SALINI-TY AND TEMPERATURE ON THE SURVIVAL OF YOUNG LIMANDA LIMANDA. Leeds Univ. (England). Wellcome Marine Lab. For primary bibliographic entry see Field 5C. W76-06148

EVALUATION OF SURFACE WATER POLLU-TION AT SEVERAL POINTS IN RELATION TO ZONES OF SHELLFISH INDUSTRY IN ROAD-STEADS OF THE BREST REGION, (IN FRENCH), For primary bibliographic entry see Field 5B.

W76-06150

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

BUFFERED, WEAK ION-EXCHANGE WATER DEMINERALIZATION PROCESS, Aerojet-General Corp., El Monte, Calif.

U.S. Patent No. 3,928,192, 9 p, 2 fig, 3 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1781-1782, December 23, 1975.

*Demineralization, Water qual Descriptors: treatment. quality control, *Desalination, Water purification, *Ion exchange Anion exchange, Cation exchange, Industrial wastes, Tertiary treatment, Brackish water, *Waste water treatment.

The process of this invention allows the efficient use of weak 'acid' cation and weak 'base' anion exchange resins in a separated, fixed-bed or moving bed, both current and countercurrent configurations for the purpose of removing 'soluble' water soluble salts dissolved in brackish and waste water streams. The process comprises the steps of passing the feed stock through a weak cation resin buffered with a suitable weak base, such as, an organic amine and exchanging the cations of the feed for the buffer cation. The released buffer cation

WATER SUPPLY AUGMENTATION AND CONSERVATION-Field 3

Saline Water Conversion—Group 3A

and the anions of the feed water minerals and anion exchange resin combine to remove the anions, releasing hydroxyl ion to form buffer hydroxide (i.e., the buffer in its free base form). The released buffer is then deposited on a further bed of weak cation exchange resin which when loaded is used as the first bed of the next demineralization cycle while the first bed is regenerated. The resin columns may be provided in alternating pairs (head-tail sequence) of two cation resin columns in series with at least one anion resin columns. The system will cleanse source water in unlimited quantity and will eliminate brine disposal if used in conjunction with specialized regeneration techniques now available. (Sinha-OEIS)

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sin orINHIBITION OF SCALE DEPOSITION, Calgon Corp., Pittsburgh, Pa. (Assignee). For primary bibliographic entry see Field 5D. W76-05529

DETECTION DEVICES FOR USE IN SOLUTION PROCESSING SYSTEMS,
Water Purification Associates, Cambridge, Mass.

(Assignee).
For primary bibliographic entry see Field 5F.
W76-05532

ECONOMIC MAGNITUDES AND ECONOMIC ALTERNATIVES IN LOWER BASIN USE OF COLORADO RIVER WATER.

Arizona Univ., Tucson. Dept. of Agricultural Economics.
W. E. Martin.

Natural Resources Journal, Vol. 15, No. 1, p. 229-239, 1975. 3 tab., 13 ref.

Descriptors: *Colorado River, *Desalination plants, *Alternate planning, *Cost-benefit analysis, United States, Mexico, Treaties, Arizona, Irrigation districts, Return flow, Water conservation, Irrigation practices, Sprinkler irrigation, Annual costs, Irrigation water, Flood irrigation.

Alternatives are proposed to a \$115 million project to include a water desalting plant to reduce the salinity of water delivered to Mexico from the Lower Colorado River as irrigation drainage return flow. Much of the salinity concentration is generated by about 27,000 acres of cropland, using about 336,000 acre-feet of water on the mesa Yuma County, Arizona. The mesa specializes in citrus production where net returns may reach \$300 to \$400 per acre. To overcome the farmers' resistance to investment in substituting sprinkler or trickle irrigation for the present flood irrigation system in order to reduce the return flows, several incentives are proposed. The reduced revenues to the farmers' cooperative irrigation district because of less water sold could be compensated through the sale of electrical energy to run the sprinklers, which would generate a saving of \$9.00 per acre. Another alternative would be to pay the farmers \$114 per acre per year for the next 50 years. It is estimated that the annual cost of desalting the drain water from these farms could buy out the farms themselves in from 2 to 9 years. The yearly cost of desalting the drain water would equal the one-time cost of investment in sprinkler or trickle irrigation systems in 2 to 3 years. (Auen-Wisconsin) W76-05811

DESALINATION APPARATUS,

Zeoplant Co. Ltd., Osaka (Japan). (Assignee). N. Maruichi.

U.S. Patent No. 3,930,958, 4 p, 6 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 414, January 6, 1976.

Descriptors: "Patents, "Desalination, "Water treatment, Water purification, Sea water, "Evaporation, "Condensation, "Desalination apparatus, Separation techniques, Heat pumps, Thermal properties. Identifiers: Solar energy.

The invention provides a multi-effect desalination apparatus (performing both evaporation and condensation of salt water), wherein the effective utilization of thermal differences is achieved by leading the sea water between the fixed thermal difference and making use of the calorie of vapor for double purpose and effect. The apparatus comprises, in combination, at least three evaporatingcondensing elements coaxially superposed in a vertical structure, with circumscribing rims and in-ward declining bottom diaphragms. A feed tube above the topmost one of the elements introduces salt water. The diaphragms have upward diverging inner walls defining central ducts which constitute an axial passageway through the structure. Liquidconveying discharge pipes lead from each of the elements to the next lower element, except for the lowermost one which has instead a tube for discharging concentrated salt water. There are means for heating the lowermost element, a drain receiver below the lowermost one of the ducts for leading away condensed vapors, and condensation-promoting, drop-inhibiting layers applied to the undersides of at least some of the diaphragms. The layers may be in the form of a metallic mesh. Although not within the framework of the invention, solar energy can be used effectively as a heat source and a heat pump can be used as an assistant heat source. (Sinha-OEIS) W76-05959

METHOD OF PREVENTING SCALE FROM BEING DEPOSITED IN CASE OF PRODUCING FRESH WATER, FROM SEA WATER, Industrial Science and Technology, Tokyo

Industrial Science and Technology, Tokyo (Japan). (Assignee). K. Hirota, Y. Takata, Y. Arikawa, K. Tanno, and

K. Hirota, Y. Takata, Y. Arikawa, K. Tanno, ar Y. Okajima.

U.S. Patent No. 3,932,273, 5 p, 1 fig, 1 tab, 3 reg; Official Gazette of the United States Patent Office, Vol 942, No 2, p 869, January 13, 1976.

Descriptors: *Patents, *Desalination, *Sea water, *Water treatment, *Water purification, *Scaling, *Desalination processes, Flash distillation, Vapor compression distillation, Chemical reactions.

A method is disclosed for preventing scale from being deposited on the heat transfer surface of apparatus for producing fresh water from sea water. A method of preventing alkaline scale in a vapor pressure type evaporator and a multiple flash evaporator comprises adding to the sea water a small amount of a seed crystal selected from the group consisting of calcium carbonate and magnesium hydroxide and at least one surface active agent selected from the group consisting of nonionic surface active agent and cation surface active agent. The temperature of the sea water is controlled to about 120 deg C or lower so as to prevent deposition of hard scale. The surface agent exhibiting no flocculation effect for the scale crystal making the scale component grown on the seed crystal is effective to prevent the scale from being deposited. The surface active agents have their single molecule adhered to fine rains of the scale component, and as a result, can mitigate the electric charge of the scale component, whereby the scale component is easily grown on the seed crystal. The surface active agent having this effect is a cation surface active agent which is quaternary ammonium salt and a nonionic surface active agent such as polyoxyethylene alkylamine that contains its molecule a nitrogen atom having a weak positive electric charge. (Sinha-OEIS) MULTISTAGE FLASH EVAPORATOR FOR PRODUCING SOFT WATER FROM A SALINE WATER.

Societa Italiana Resine S.p.A., Milan (Italy). (Assignee).

D. Barba, A. Germana, G. Liuzzo, G. Tagliaferri, and G. Spizzichino.

U.S. Patent No. 3,933,597, 5 p, 5 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1334, January 20, 1976.

Descriptors: *Patents, *Desalination, *Demineralization, *Saline water, *Water softening, *Water purification, Water quality control, Flash distillation, Condensation, Evaporation, Desalination apparatus, Separation techniques.

A multistage flash-evaporator for producing soft water from a saline water comprises: a horizontal, uninterrupted rectilinear tubular shell having a pair of transverse end walls; a number of longitudinally spaced transverse partition walls in the shell subspaced transverse partition walls in the snell sub-dividing the inside into a series of consecutive distilling units; and a longitudinally extending hood in each unit subdividing the inside of the unit into an evaporation chamber and a condensation chamber. The longitudinally extending hood in-cludes a filtering zone pervious to steam through which the evaporation chamber is connected with its associated condensation chamber in the unit. Normally submerged passages in each partition wall allows a continuous flow of saline water through the evaporation chambers in the consecutive units; and a condensor in each unit comprises a rectilinear bundle of heat exchange tubes extending longitudinally in the condensation chamber. The crude saline water is continuously supplied to the condenser in one end unit of the evaporator to provide a coolant flowing in the condenser tubes throughout the whole length of the evaporator. The crude saline water discharged from the condenser in the opposite end unit is then heated to a suitable temperature and is delivered to the evaporating chamber from which it flows through all the units. The units operate at absolute valu decreasing in the direction of flow of the saline water and the steam flashing out from the saline water in each unit is condensed on the tubes of the condenser and is collected. (Sinha-OEIS) W76-05978

METHOD AND APPARATUS FOR DESALINIZATION OF WATER, A. Y. Dodge.

U.S. Patent No. 3,933,600, 5 p, 4 fig, 14 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1335, January 20, 1976.

Descriptors: *Patents, *Desalination, *Saline water, *Water purification, *Desalination apparatus, *Water vapor, Evaporation, Distillation, Scaling, Desalination wastes, Separation techniques, Potable water.

A primary object of this invention is to vaporize salt-free water from a body of salt-containing water in a manner to reduce the tendency for scale to deposit on surfaces which are in contact with the salt-containing water. Water containing dissolved salt is introduced into a closed vessel and is partially vaporized by direct contact of the water with a flame. As much as one-half to three-fourths of the water is transformed into vapor and a residue of unvaporized water of correspondingly increased salt content, e.g., three times as much salt as the initial water, is collected at the bottom of the vessel for continuous or intermittent discharge. A gaseous mixture of vaporized water and combustion products is drawn off from the top of the vessel and passed through a condenser in which the water vapor is condensed. A second feature is practiced in combination with the closed vessel in which a branch stream of the feed water is heated to moderately low temperature and is injected by spraying into the upper part of a second vessel which is also closed and is operated at a reduced pressure, sufficiently low to cause partial

Field 3-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A-Saline Water Conversion

vaporization of the injected water to a desired extent. The unvaporized residue, enriched in salt, is collected in the lower part of the second vessel. A low pressure is maintained within the second vessel by reducing the pressure of the water vapor discharged from the top, as well as the pressure of the residual water within the vessel, which is discharged from the bottom. (Sinha-OEIS) W76-05979

DESALINATION PROCESS BY IMPROVED MULTISTAGE ELECTRODIALYSIS, Ashi Kasei Kogyo Kabushiki Kaisha, Osaka (Japan). (Assignee).

(Japan), (Assignee), L. Ehara, T. Miwa, and M. Kamaya. U.S. Patent No. 3,933,610, 10 p, 7 fig. 8 tab, 3 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1338, January 20, 1976.

*Patents, *Scaling, *Demineralization *Membrane processes, *Permselective membranes, treatment, Water quality control, *Electrodialysis, Anions, Cations, Electrochemistry.

An electrodialysis process for the desalination of aqueous salt solutions has two or more stages for electrodialysis which are connected in series to effect dilution by reduction of total ion content in progressive stages. Each stage has multiple pairs of anionic and cationic membranes alternately placed to divide the stage into alternate dilution and concentration chambers containing dilution and concentration streams. The salt solution contains at leastone divalent anion and at least one divalent cation capable of forming an insoluble salt in the concentration stream. At least one of the divalent cations or anions are selectively retained in the dilution stream by conducting electrolysis through an anion exchange membrane which forms a boundary of the dilution chamber and has a divalent ion permselectively coefficient which is sufficiently less than one. The concentration ratio of the selectively retained divalent cation or anion to monovalent ion of the same charge in the dilution chamber is increased and the concentration product of divalent cations and anions which are capable of forming the insoluble salt in the concenproduct of the insoluble salt. (Sinha-OEIS) W76-05980

METHOD OF OPERATING ION EXCHANGE

Permutit Co., Paramus, N.J. (Assignee). For primary bibliographic entry see Field 5F. W76-05983

REVERSE OSMOSIS SEPARATION PARATUS.

Toray Industries, Inc., Tokyo (Japan). (Assignee).

N. Kanamaru, and H. Fujino. U.S. Patent No. 3,933,646, 6 p, 10 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1350, January 20, 1976.

Descriptors: *Patents, *Reverse osmosis, *Membrane processes, *Membranes, *Water treatment, *Desalination processes, Laminar flow, Water quality control, Separation techniques Identifiers: Spiral passages.

A reverse osmosis separation apparatus comprises a cylindrical chamber and a membrane module with its axiscoaxial to the chamber. The module is comprised of a hollow mandrel having a hole or axially aligned holes on its outer circumference and a pair of membrane sheet spaced apart from each other by spacing layers and spirally wound about the mandrel to form a first spiral passage for a permeated solution between the opposite inner surfaces of the sheets and to form a second spiral passage for a feed solution between the opposite outer surfaces of the sheets. The first passage is

closed at the outer edges of the entire lengths of closed at the outer eages of the entire tengins of the sheets and has an outlet connected with the in-terior of the mandrel. The second passage has an inlet and an axial outlet opening at the spiral edges of the sheets in the vicinity of the mandrel. The first and second passages are closed at the op-posite spiral edges of the sheets except for the par-tial length where the axial outlet opening is formed. Means are provided for supplying the feed solution into the chamber to allow it to flow into the second passage from the inlet opening in a direction perpendicular to the axis; means for discharging the nonpermeated solution having flowed out through the axial outlet opening of the second passage from the chamber and mean for discharging the permeated solution having flowed into the interior of the mandrel. The feed solution passes spirally through the second passage while a solution having a concentrated solvent permeates from the feed solution by reverse osmosis. (Sinha -W76-05990

APPARATUS FOR THE SEPARATION OF LIQUID MIXTURES MY MEANS OF PERMEABILITY SELECTIVE SEPARATION MEM-BRANES

Louis Schleiffer A. G., Feldbach (Switzerland). F. Muller.

U.S. Patent No. 3,933,647, 5 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1350, January 20, 1976.

Descriptors: *Patents, *Membrane processes, *Separation techniques, *Permselective mem-branes, *Waste water treatment, *Water treatbranes, *Desalination apparatus, Water quality control, Water pollution control.
Identifiers: Perstraction, Pervaporation

An apparatus for the separation of liquid mixtures by means of permselective separation membranes comprises at least one separation module incorporating a distributor plate, a collector plate and an intermediately situated separation membrane. The separation module can be operated with different types of separation membranes both under high pressure as well as under high vacuum. The distributor plate at the region of the effective membrane surface has at least one throughflow opening arranged at the periphery for the mixture to be separated-out as well as one open flow channel extending along a curved line from this opening to the center of the membrane. The flow channel is arranged such that the mixture is exposed along one side of the membrane to a turbulent flow for the successive flushing of the membrane surface along a serpentine-shaped or undulated path from the periphery to the center. The membrane possesses an axial throughflow opening into which opens the flow channel. The collector plate has an axial bore, a substantially ring-shaped recess opposite the flow channel, and a highly porous carrier element arranged in the ring-shaped recess for uniformly supporting the membrane at its exit or discharge side as well as at least one collecting channel leading from the periphery of the ring-shaped recess towards the outside. The carrier element is constructed to be pressure resistant and highly porous in such a way that it can permit a rapid unhindered flowing-off of the material which flows through and out of the membrane via the recess to the collecting channel without any considerable pressure drop and at the same time op-posing any bending-through of the membrane. (Sinha-OEIS) W76-05991

OPERATION OF PILOT PLANT EVAPORATOR AT WRIGHTSVILLE BEACH, NORTH CAROLINA.

Badger (W. L.) Associates, Inc., Ann Arbor, Mich. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-161 290 as 5.00 in paper back, \$2.25 in microfiche. -- OSW/RDPR/26, December 1959. 103 p., 59 fig, 3 tab, 6 ref. DoI 14-01-001-93

Descriptors: *Desalination, *Distillation, *Heat transfer, *Evaporators, *Long-Tube Vertical Distillation, Corrosion, Scaling, Construction materials, North Carolina, Pilot plants. Identifiers: Rising film, Falling film, Forced circuth th th st tie th

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A pilot plant was bulit as a single effect Long Tube Vertical (LTV) Evaporator supplemented by two Forced Circulation (FC) Evaporators. To obtain results which could be translated to commercial installations, the system was built with sufficient flexibility to permit operation under the conditions which would exist in any effect of a twelve effect system including one stage of thermocompression. The LTV was set up to operate in either a rising film or a falling film mode from either forward or backward feed. Experimental work was carried out on both rising film and faling film heat transfer coefficients, on scale prevention and on corrosion. It was determined that falling film operation pro-vides better heat transfer than does rising film operation. W76-06049

3B. Water Yield Improvement

JUDGING THE AVAILABILITY OF GROUND WATER.

For primary bibliographic entry see Field 4B. W76-05558

EFFICIENT WELLS SAVE ENERGY AND REDUCE COSTS.

Universal Oil Products, St. Paul, Minn. Johnson

For primary bibliographic entry see Field 4B. W76-05563

YUKON CITY'S NEW WELL REPLACES FIVE OLDER ONES,

Hydrogeological Consultants Ltd., Edmonton (Alberta). For primary bibliographic entry see Field 4B. W76-05566

CLASSIFICATION OF METHODS MANAGEMENT GROUNDWATER (KLASSIFICAKSIIYA METODOV UPRAVLENIYA REZHIMOM I RESURS PODZEMNYKH VOD), For primary bibliographic entry see Field 4B.

W76-05600

FIELD OBSERVATIONS OF THE PER-SISTENCE OF AGI-NH4I-ACETONE ICE NUCLEI IN DAYLIGHT,

Bureau of Reclamation, Miles City, Mont. Div. of Atmospheric Water Resources Management.

A. B. Super, J. T. McPartland, and J. A. Heimbach, Jr.

Journal of Applied Meteorology, Vol. 14, No. 8, p 1572-1577, December 1975. 2 fig, 1 tab, 23 ref. Bu Rec 14-06-D-6798.

Descriptors: *Cloud seeding, *Silver iodide, *Weather modification, Nucleation, Sampling, Aircraft, Precipitation(Atmospheric), Artificial precipitation, Meteorology. Identifiers: *Ice nuclei, Ice nuclei persistence,

Silver iodide plumes.

A field method of estimating the persistence of a commonly used silver iodide seeding agent was described. The method involved measurement of the AgI plume structure at two downwind distances from the ground generator(s). Distances between the nine available pairs of downwind measurement planes ranged from approximately

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Conservation In Domestic and Municipal Use—Group 3D

10 to 100 km. An NCAR acoustical ice nucleus counter in a light twin aircraft was used to sample the AgI plumes. A series of passes was made through the entire vertical and horizontal extent of the plume at each downwind distance. These measurements, together with pilot balloon observations, permitted calculation of the flux of AgI through each vertical cross-sectional plane. The through each vertical cross-sectional plane. The difference in flux measurements yielded an estimate of the persistence of the seeding agent over the period of transport between the two vertical planes. This method was applied at three separate locations, during different seasons, and with various degrees of cloudiness. Resulting estimates of deactivation rates of the ice nucleating ability of AgI ranged from no loss to 70% loss per hour. The implications for possible cloud seeding effects beyond the intended target area were discussed. (Sims-ISWS) (Sims-ISWS) W76-05677

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Water Resources Program. For primary bibliographic entry see Field 4A. W76-05819

GROUNDWATER STUDY OF A VOLCANIC AREA NEAR BANDUNG, JAVA, INDONESIA, Cowiconsult Ltd., Copenhagen (Denmark). For primary bibliographic entry see Field 4B. W76-05914

EXPLOITATION OF THE WATERS OF SUB-PERMAFROST ARTESIAN BASINS.

PERMAFROST ARTESIAN BASINS,
A. A. Gubanov, and B. A. Gubanov.
Soviet Hydrology, Selected Papers, No. 1, p 64-66, 1974. 1 fig., 2 tab, 7 ref. Translated from Hydraulic Engineering and Reclamation (Gidrotekhnika i melioratsiya), No. 2, p 90-92, 1074

Descriptors: *Permafrost, *Deep wells, *Water wells, *Thawing, Irrigation wells, Water wells, Heating, Electrical equipment, Electric wires, Electric cables. Identifiers: *USSR, *Siberia.

Huge groundwater reserves, of a quality suitable for industrial use and drinking, and representing a reliable base for agricultural water supply, are concentrated in the subpermafrost artesian basins of East Siberia. However, the low temperatures of of East Siberia. However, the low temperatures of the aquifers (0.1-1 C) and the great thickness of the permafrost (up to 350 m) complicate the exploitation of artesian wells, frequently result in the freezing of the water in the wells and thus inhibit the organization of temporary water supply to cultivating pastures, field stations, etc. To prevent the freezing of artesian wells, a method of heating the water column in the wells with a linear electric beater he had adverted and intended the state the heater has been developed and introduced into the practice of agricultural water supply. (Sims-ISWS) W76-05930

DETECTION AND PRELIMINARY IDENTIFICATION OF ENDOGENOUS ANTITRANS-PIRANTS IN WATER-STRESSED SORGHUM

Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences. For primary bibliographic entry see Field 21. W76-06026

3C. Use Of Water Of Impaired Quality

POND AND IRRIGATION SYSTEMS OFFER ECONOMY AND FLEXIBILITY, William and Works, Grand Rapids, Mich. For primary bibliographic entry see Field 5D. W76-05774

WATER FACTORY 21 IS THE FUTURE. Toups Corp., Santa Ana, Calif. For primary bibliographic entry see Field 5F. W76-05782

DESIGN, OPERATION, AND MONITORING OF MUNICIPAL IRRIGATION SYSTEMS, Williams and Works, Grand Rapids, Mich. For primary bibliographic entry see Field 5E. W76-05783

ECONOMIC MAGNITUDES AND ECONOMIC ALTERNATIVES IN LOWER BASIN USE OF COLORADO RIVER WATER,

Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3A.

PRINCIPAL ECONOMIC ASPECTS OF THE PROBLEM OF SALINITY OF THE COLORADO

Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Relaciones Internacionales. For primary bibliographic entry see Field 6E. W76-05821

SALT TRANSPORT IN SOIL PROFILES WITH APPLICATION TO IRRIGATION RETURN FLOW, THE DISSOLUTION AND TRANSPORT OF GYPSUM IN SOILS, Colorado State Univ., Fort Collins. Dept. of

Agronomy.

For primary bibliographic entry see Field 5B. W76-05836

METHOD AND APPAR DESALINIZATION OF WATER, APPARATUS FOR For primary bibliographic entry see Field 3A. W76-05979

IONIC LEAF ACCUMULATION IN GRAPES, GUAVA AND OLIVE PLANTS AS AFFECTED BY THE SALINITY OF IRRIGATION WATER, Alexandria Univ. (Egypt). Faculty of Agriculture M. W. Taha, E. El-Azab, and Z. Fadiah. Alexandria J Agric Res. 20(2): 299-309. 1972.

Descriptors: Salinity, Irrigation water, *Fruit crops, *Salt tolerance, Calcium chloride, *Ions, *Leaves, Nitrogen, Nutrients, *Chlorides. Identifiers: Grapes, Guava, Olea-Europaea, Olive, Psidium-Guajava, Vitis-Vinifera.

One yr old Thompson seedless vines, Roumi red vines (Vitis vinifera), guava (Psidium guajava) and olive (Olea europaea) plants grown in sand culture were irrigated with water containing different concentrations, up to 8000 ppm, of CaC12 plus NaC1 (1:1 ratio). As the salinity level of the water used for irrigation increased, a subsequent increase was observed in the accumulation of C1. Na and Ca in the leaves of the 3 plant species. Accumulation of C1 was much lower in the olive leaves, under all treatments, as compared with the other plants. Tentative critical leaf C1 levels are: 1.50, 1.60, 2.30 and 1.14% for Thompson seedless, Roumi red, guava and olives, respectively. Reduction in growth and appearance of salt injury are expected at higher C1 levels than the suggested ones. Toxat higher C1 levels than the suggested ones. Ioxicity symptoms together with reduced growth were generally observed when Na in the leaf was over and above 1.50% in the 2 grape cultivars and guava, while in olives values of about 0.75 to 0.90% were critical. The leaf N of the plants showed a slight and irregular increase with insnowed a signt and irregular increase with in-creasing the salinity level, indicating no severe salinity effect on N. Both P and K decreased as the salinity level increased, while Mg did not follow any definite pattern under the different treat-ments.—Copyright 1975, Biological Abstracts, Inc. W76-06030 THE INTERNATIONAL LAW ASPECTS OF THE GARRISON DIVERSION PROJECT, For primary bibliographic entry see Field 6E. W76-06053

3D. Conservation In Domestic and Municipal Use

DECISION PERSPECTIVES STORM WATER POLLUTION, GKY and Associates, Alex., Va. ON URBAN For primary bibliographic entry see Field 5D. W76-05509

PROCEEDINGS - CONFERENCE ON WATER CONSERVATION AND SEWAGE FLOW REDUCTION WITH WATER-SAVING DEVICES.

Pennsylvania State Univ., University Fark. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 5D. W76-05602

HANLON CREEK ECOLOGICAL STUDY, PHASE B.

Guelph Univ. (Ontario). Centre for Resources Development.
For primary bibliographic entry see Field 6G. W76-05650

PERSPECTIVE 75. East Central Florida Regional Planning Council, Winter Park. For primary bibliographic entry see Field 6B. W76-05651

WATER'S MOST EFFICIENT SYSTEM. For primary bibliographic entry see Field 6C. W76-05655

URBAN WATER MANAGEMENT OF AN IN-TERNATIONAL RIVER: THE CASE OF EL PASO-JUAREZ, University of Western Ontario, London. Dept. of

Geography. J. C. Dav.

Natural Resources Journal, Vol. 15, No 3, p 453-470, July 1975. 6 fig, 1 tab, 50 ref.

Descriptors: *Water management(Applied), *Rio Descriptors: "Water management(Applied), "Rio Grande River, "International waters, "Mexico, "River basin development, "Comprehensive planning, Riparian rights, Water demand, "Water policy, Aquifers, "United States, International Boundary and Water Commission, Federal Government, Potential water supply, Arid lands, Legislation, Institutional constraints, Water allo-cation(Policy), Groundwater, "Texas. Identifiers: El Paso(TX), Ciudad Ingarg/Chibushua-Mexico)

Juarez(Chihuahua-Mexico).

The experience of El Paso, Texas and Ciudad Juarez, Mexico, adjacent cities located at up-stream end of the Rio Grande suggests two problems: difficulties in arid land river basin development and in uncoordinated groundwater appropriation on an international boundary. In-stitutions and laws which guide water use in both countries and decisions which determine dividing river flow and allocating surface water resources are reviewed. Divergences include water owner-ship and responsibility for allocation and control. In Texas groundwater belongs to individual property owners for unlimited use, while in Juarez water is owned and controlled by the federal government. Information on water sources and reserves, pricing and rates of use is compared for both countries. Demand schedules indicate that El Paso's consumption is 3 times greater than Juarez which has much less area devoted to lawns and gardens and fewer evaporative coolers and

Field 3-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3D—Conservation In Domestic and Municipal Use

swimming pools. Chief source of water is from contiguour groundwater fields in the Rio Grande Valley. Saline water underlies, overlaps, and ad-joins fresh-water aquifers of the Texas artesian joins fresh-water adulters of the lexas artesian area. All wells must be cased to avoid contamination by salt water into fresh-water stocks. Some conclusions are that the interrelationship of resource use has not been perceived as altering water quality or quantity; international liason to water quanty or quantity; international hason to ensure a rational water appropriation policy is needed; and mutually acceptable standards for groundwater protection and development should be established and enforced, probably by the International Boundary and Water Commission. (Salzman - North Carolina). W76-05661

SUPER TEAMWORK GIVES GREEN BAY (WISCONSIN) A SUPER WASTE TREATMENT

For primary bibliographic entry see Field 5D. W76-05706

REVERSE OSMOSIS PLANT HELPS CITY COPE WITH DIMINISHING GROUNDWATER

Dacy (G. H.) Associates, Inc., Miami, Fla For primary bibliographic entry see Field 5F. W76-05779

THE MASTER PLAN FOR WATER SUPPLY IN THE REGIONAL MUNICIPALITY OF OTTAWA-CARLETON, Ottawa-Carleton Regional Municipality (Ontario).

For primary bibliographic entry see Field 6D. W76-05815

RESTORING THE QUALITY OF URBAN RECEIVING WATERS: INTERFACING UP-GRADED TREATMENT FACILITIES WITH

THE STREAM,
Clemson Univ., S. C. Dept. of Environmental

Systems Engineering.
For primary bibliographic entry see Field 5D.
W76-05839

3E. Conservation In Industry

INHIBITION OF SCALE DEPOSITION, Calgon Corp., Pittsburgh, Pa. (Assignee). For primary bibliographic entry see Field 5D. W76-05529

LEACHING POLYELECTROLYTE FLUIDIZED SOLIDS

American Cyanamid Co., Stamford, Conn. (Assignee). For primary bibliographic entry see Field 5D. W76-05536

METHOD AND APPARATUS FOR CENTRIFU-GALLY SEPARATING FINELY DIVIDED SOLIDS FROM AQUEOUS SUSPENSIONS THEREOF,

Canadian Patents and Development Ltd., Ottawa (Ontario). (Assignee). For primary bibliographic entry see Field 5D. W76-05543

FILTERING APPARATUS AND PROCESS. Gaston County Dyeing Machine Co. Mount Holly, N. C. (Assignee). For primary bibliographic entry see Field 5D.

HOW STEAM IS PRODUCED AND HANDLED AT THE GEYSERS.

For primary bibliographic entry see Field 8C. W76-05574

W76-05546

PROCEEDINGS - CONFERENCE ON WATER CONSERVATION AND SEWAGE REDUCTION WATER-SAVING

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 5D. W76-05602

ENERGY REQUIREMENTS FOR CONVENTIONAL AND ADVANCED WASTEWATER TREATMENT.

Ontario Ministry of the Environment, Toronto. Applied Science Section. or primary bibliographic entry see Field 5D. W76-05702

EXPERIMENTS ON THE OPTIMIZATION OF SLUDGE DEWATERING AND ON THE USE OF BARK AND SLUDGE IN THE BRICK INDUS-TRY (VERSUCHE ZUR OPTIMIERUNG DER SCHLAMMENTWAESSERUNG UND ZUR VER-WERTUNG VON RINDE UND SCHLAMM IN

DER ZIEGELINDUSTRIE), Papiertechnische Stiftung, Munich (West Ger-

For primary bibliographic entry see Field 5D. W76-05704

SUPER TEAMWORK GIVES GREEN BAY (WISCONSIN) A SUPER WASTE TREATMENT PLANT,

For primary bibliographic entry see Field 5D. W76-05706

SYMPOSIUM ON WATER PURIFICATION (SYMPOSIUM OVER VATTENRENING), For primary bibliographic entry see Field 5D. W76-05711

ENVIRONMENTAL ASPECTS OF THE USE OF ENVIRONMENTAL ASPECTS OF THE USE OF STARCHES IN THE PAPER INDUSTRY (HLEDISKA OCHRANY ZIVOTNIHO PROSTREDI PRI POUZIVANI SKROBOVYCH PRODUKTU V PAPIRENSKEM PRUMYSLU), For primary bibliographic entry see Field 5B. W76-05720

POSITION OF A CALCIUM BISULFITE PULP MILL PARTICULARLY WITH RESPECT TO INTENSIFIED ENVIRONMENTAL PROTEC-TION REQUIREMENTS (DIE POSITION EINER KALZIUMBISULFITFABRIK, BESONDERS IM HINBLICK AUF VERSCHAE WELTSCHUTZFORDERUNGEN), VERSCHAERFTE

Helsinki Univ. of Technology, Otaniemi Finland. For primary bibliographic entry see Field 5G. W76-05722

REDUCTION OF EFFLUENT VOLUME AND FRESH WATER CONSUMPTION (SNIZHENIE OB'EMA CTOCHNYKH VOD I RASKHODA

SVEZHEJ VODY), Vsesoyuznyi Nauchnii Planovii Otdel Bumazhnoi Promyshlennosti Moscow (USSR).

G. L. Akim, and T. A. Bystrova Bumazhnaya Promyshlennost, No. 8, p 17-20, Aug., 1975. 1 fig, 1 tab.

Descriptors: *Water conservation, *Pulp and paper industry, *Bleaching wastes, Sulfite liquors, Wastes, Industrial wastes, Pulp wastes, Water pollution sources, Biological treatment, Biochemical oxygen demand, Chemical oxygen demand, Recycling, Oxidation, Water consumption (except consumptive use), Foreign countries. Identifiers: "Sulfite pulp mills, Dissolving pulp, Spent sulfite liquor, Soviet Union(USSR).

A process has been developed for the manufacture of sulfite dissolving pulp in which the cooking

liquor is prepared from spent liquor of oxygen-alliquor is prepared from spent fiquor of oxygen-ai-kali bleaching. There is no chlorination, the pulp after the oxygen-alkali treatment being bleached with hypochlorite dioxide. Following oxygen-ai-kali treatment the liquor (5.5-6.5 cu m/ton of pulp) is squeezed out, and the liquor containing 4-6 g of is squeezed out, and the liquor containing 4-6 g of sodium oxide/liter is used for the preparation of cooking liquor. The pulp is washed and the wash water is used for the preparation of NaOH solu-tion and for pulp dilution prior to oxygen-alkali treatment. Spent bleaching liquors are used for reament. Spent bleaching and for unbleached pulp dilution after bleaching and for unbleached pulp screening. Spent liquor from bleached pulp acidification is also used for this purpose. The water consumption is drastically reduced, and about 95% sodium oxide is recycled into the process. The spent sulfite liquor, which has a high content of organic and inorganic substances, is used for biological processing so that the final overall effluent from the process contains spent liquor from hypochlorite bleaching and 5% of spent liquor from oxygen-alkali treatment. Its BOD and COD, compared to the conventional process, are very low, and it is easily purified by biological oxidation. (Stapinski-IPC)

TRANSFER OF LINDANE FROM BARK OF IN-SECTICIDE-SPRAYED PINE PULPWOOD INTO EFFLUENT FROM A BARKING DRUM (LINDAANIN HUUHTOUTUMISESTA SUOJARUISKUTETUN MANTYKUITUPUUN KUORESTA RUMPUKUORIMON JATEVETEEN)

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Finnish Forest Research Inst., Helsinki. For primary bibliographic entry see Field 5B. W76-05734

UTAH'S THIRD YEAR OF PLANNING FOR THE FOUR CORNERS REGIONAL COMMIS-

Utah Planning Commission, Salt Lake City. For primary bibliographic entry see Field 6B.

COMPARATIVE RISK-COST-BENEFIT STUDY OF ALTERNATIVE SOURCES OF ELECTRI-

CAL ENERGY, Atomic Energy Commission, Washington, D. C. For primary bibliographic entry see Field 6B. W76-05829

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS COAL REGION OF EASTERN MONTANA, 1975-76, Geological Survey, Helena, Mont. For primary bibliographic entry see Field 7C. W76-05853

THE ECONOMICS OF CLEAN WATER. VOLUME III. INDUSTRY EXPENDITURES FOR WATER POLLUTION ABATEMENT. Conference Board, Inc., New York. For primary bibliographic entry see Field 5G. W76-05951

METHOD OF REDUCING SLUDGE ACCUMU-LATION FROM TAR SANDS HOT WATER

Great Canadian Oil Sands Ltd., Toronto (Ontario). (Assignee).
For primary bibliographic entry see Field 5D.
W76-05965

METHOD OF EXTRACTING HEAVY METALS FROM INDUSTRIAL WASTE WATERS, Nippon Electric Co. Ltd. Tokyo (Japan). For primary bibliographic entry see Field 5D. W76-05966

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

Conservation In Agriculture—Group 3F

PROCESS FOR THE TREATMENT OF MINERAL SLIMES.

Amax Resource Recovery Systems, Inc., Dayton, Ohio. (Assignee). For primary bibliographic entry see Field 5D. W76-05973

PURIFICATION OF WASTE WATER CONTAINING PHTHALIC ESTERS.

Rhone-Progil, Courbevoie (France). (Assignee). For primary bibliographic entry see Field 5D. W76-05982

NORTHERN GREAT PLAINS RESOURCE PRO-

GRAM. Northern Great Plains Resources Program, Denver Colo

For primary bibliographic entry see Field 6D. W76-06050

REFORMING PROCEDURES FOR INDUSTRI-AL SITING, For primary bibliographic entry see Field 6E.

W76-06058

3F. Conservation In Agriculture

WATER LINE,

W76-05541

Identifiers: Flexible pipe.

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Uniflex S.P.A., (Italy). (Assignee). G. Brusadin, and G. Prosdocimo. U. S. Patent No. 3,929,288, 4 p, 9 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 941, No 5, p 2130, December 30, 1975.

Descriptors: *Patents, *Water tion(Applied), *Irrigation, *Irrigation systems. Piplines, Irrigation efficiency, Pipes, Flow con-

The device described allows a rapid and easy construction of water distribution systems with flexible pipes. The distribution system can be laid out on the surface of the ground or completely underground. The device connecting distribution lines and providing for branches comprises a box body having an open top and at least two lateral diametrially opposed openings. A cover selectively closes the top of the box. A duct body positioned in the box has two lateral projections, one each extending toward one of the lateral openings in the box body, and a centrally located upward extending projection extending toward the open top of the box. The upward projection has a nozzle for coupling to a water utilization device and containing an automatic valve. The duct body forms interconnected passages through each of the lateral projections and the upward projection. The box can be secured to the ground. (Sinha - OEIS)

ALLOWANCE FOR PRECIPITATION AND RU-NOFF FLUCTUATION PATTERNS IN COM-PUTING WATER WITHDRAWAL FOR IR-RIGATION SYSTEMS IN THE SOUTHERN UKRAINE,

Ukrainskii Nauchno-Issledovatelsi Gidrometeorologicheski Inst.(USSR). For primary bibliographic entry see Field 4A W76-05675

THE COLUMBIA BASIN PROJECT REAP-

Central Washington State Coll., Ellensburg. For primary bibliographic entry see Field 4A. W76-05750 WATER RESOURCES DEVELOPMENT IN THE GANGA-GHAGRA INTERBASIN IN UTTAR PRADESH (INDIA),

Central Board of Irrigation and Power. New Delhi (India)

For primary bibliographic entry see Field 4A. W76-05763

IMPACT SPRINKLER,

Johns-Manville Corp., Denver, Colo. (Assignee). C. W. Dunmire.

U.S. Patent No. 3,930,617, 5 p, 5 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 308, January 6, 1976.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation practices, Irrigation efficiency, Application equipment, Water distribu-tion(Applied). Identifiers: *Impact sprinkler, Plastic.

An impact sprinkler has a plastic water deflector and an improved water distribution pattern specifically at the outlying areas of the pattern. The sprinkler comprises a main body including a nozzle and a cylindrical water deflector support pin around which a water deflector is pivotally mounted. The water deflector is constructed of plastic and includes a water deflecting segment movable into and out of a jet of water issuing from the nozzle as the deflector pivots about the support pin. The water deflecting segment includes a first substantially flat water deflecting surface which extends away from the nozzle and which includes opposite ends, one end of which is further from the nozzle than the other, and opposite sides extending between the opposite ends. The water deflecting segment also includes a pair of second water deflecting surfaces extending out from and joining the further end of the first surface. These second surfaces extend towards each other from opposite sides of the first surface but are spaced from one another so as to define a slot between. The slot is centrally located between the sides of the first surface. In this manner the water in the center of the jet deflects off the first surface and passes through the center slot without being deflected by the outwardly directed second surfaces, allowing it to pass ' rther out from the sprinkler than the water det.ected by the second surfaces. (Sinha-OEIS) W76-05956

BALANCED SPRINKLER IMPACT DRIVE.

G. Lockwood.

U.S. Patent No. 3,930,618, 4 p, 6 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 308, January 6, 1976.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Application Water equipment, Application equipment, tion(Applied).
Identifiers: *Impact sprinklers.

A sprinkler has a radially dynamically balanced intermittent drive system to provide a rotating sprin-kler head generally free of all objectionable vibrations. The drive system includes a striker carrier and at least two independent striker means, shown as balls. The striker means are symmetricallt positioned by the striker carrier and their generally rotary path is prescribed to radially dynamically balance the carrier member and striker means as a drive system. The driver surface means and the striker means are positioned so that a number of impacts occur simultaneously to provide an intermittent impact drive that is free of radial vibra-tions and therefore this sprinkler may be placed at great heights on stand pipes without encountering vibration problems. (Sinha-OEIS) W76-05957 WATER MOVEMENT WITHIN THE ROOT ZONE OF IRRIGATED AND NONIRRIGATED GRAIN SORGHUM, South Dakota State Univ., Brookings. Dept. of

For primary bibliographic entry see Field 2G. W76-05994 Plant Science.

ROLE OF PHENYLMERCURIC ACETATE ON STOMATAL REGULATION AND WATER LOSS IN PROSOPIS CINERARIA LINN, Jodhpur Univ. (India). Dept. of Botany For primary bibliographic entry see Field 5G. W76-06011

THE ANNUAL VARIATION IN YIELD OF PASTURES IN THE SEASONALLY DRY TROPICS OF QUEENSLAND,

Commonwealth Scientific and Industrial Research Organization, Townsville (Australia). Pastoral Research Lab.

R. L. McCown, P. Gillard, and L. A. Edye. Aust J Exp Agric Anim Husb. 14(68): 328-333.

*Australia, Vegetation, Descriptors: *Evapotranspiration, Dry farming, Seasonal, Pastures, Tropics, *Crop production.

Identifiers: Cenchrus-Ciliaris, Heteropogon-Contortus, Queensland, Stylosanthes-Humilis

Dry matter yield of 3 vegetation (Heteropogon contortus, Stylosanthes humilis and Cenchrus ciliaris)-fertilizer combinations was closely related to actual evapotranspiration estimated using sim-ple water balance model. Cumulative actual evapotranspiration was estimated for 69 yr of rainfall records and a description of annual variation in yields obtained using yield/actual evapotranspiration regressions. -- Copyright 1975, Biological Abstracts, Inc. W76-06016

EFFECT OF DIFFERENT METHODS OF PLANTING IN PUDDLED SOIL ON THE YIELD OF RICE,

V. Venkateswara Rao. Indian J Agric Sci. 43(6): 551-554. 1973.

Descriptors: *Rice, *Crop production, Farm management, *Planting management, Seeds.

A study was conducted for 3 seasons to find out A study was conducted for 3 seasons to find out the best method of growing rice (Oryza sativa L.) cultivars ('IR 8,' 'IR 20,' 'Jaya' and 'Co 29') in puddled soil. Dibbling sprouted seed in 15-cm solid rows was on a par with transplanting in the rainy season and was superior to other methods in winter for grain yield. Considering the yield and economics, dibbling sprouted seed of 'IR 8' in solid rows 15 cm apart showed a great potential. This method eliminates nursery preparation, fer-tilization, care, pulling, transporting and planting seedlings, reduces labor requirement at planting, and enables the winter crop to escape moisture stress at the grain-filling stage as it matures a week earlier than the transplanted crop.—Copyright 1975, Biological Abstracts, Inc.

SOME HELMINTHS OF BULINUS TRUNCATUS
AND BIOMPHALARIA ALEXANDRINA FROM
THE IRRIGATION SYSTEM NEAR CAIRO,
Ceskoslovenska Akademie Ved, Prague.
Parazitologicky Ustav. For primary bibliographic entry see Field 5A. W76-06028

GRAPEVINE RESPONSE TO FURROW AND TRICKLE IRRIGATION,

New York State Coll. of Agriculture, Ithaca. Dept. of Pomology.
R. E. Smart, C. R. Turkington, and J. C. Evans.
Am J Enol Vitic. 25(2): 61-66. 1974.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F-Conservation In Agriculture

Descriptors: *Furrow irrigation, *Trickle irriga-tion, Crop production, Growth rates, *Australia. Identifiers: *Grapevine growth.

The effects of trickle and furrow irrigation were determined on yield and growth of the wine grape 'Shiraz' in the hot arid climate of Griffith, New South Wales (Australia). Daily trickle irrigation applied at 0.4 the rate of class A pan evaporation (crop factor=0.4) produced similar yields to furrow irrigated vines with crop factor 0.5. Daily trickle application with crop factor of 0.2 decreased yield by 16%. Applying similar amounts of water daily or every 2nd day by trickle had similar effects on yield. Water stress up to veraison significantly reduced berry size, the yield component most sensitive to water stress .-- Copyright 1975, Biological Abstracts, Inc. W76-06032

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

SOCIOLOGICAL ANALYSIS OF DAM IMPACT: A STUDY OF TWENTY-TWO LARGE DAMS IN TEXAS,

Texas A and M Univ., College Station. Dept. of Sociology and Anthropology. For primary bibliographic entry see Field 6B. W76-05501

RESERVOIR MANAGEMENT VIA RELIABILI-TY PROGRAMMING.

Politecnico di Milano (Italy). Istituto di Elettrotecnica ed Elettronica

A. Colorni, and G. Fronza.

Water Resources Research, Vol 12, No 1, p 85-88, February 1976. 3 fig, 15 ref, append.

*Reservoirs, Management, *Reliability, *Reservoir releases, Monthly, Volume, *Reservoir operation, Profit, Risks, Al-*Reliability, gorithms, Stochastic processes, Optimization, Equations, Mathematical models, Systems analy-

Identifiers: *Chance-constrained programming, *Nonlinear programming.

The possibility of applying reliability programming for determining the monthly contract volumes to be released by a reservoir is discussed. While in standard chance constraint programming the risk of the solution is fixed a priori, here constraint reliabilities are considered as extra decision variables. Hence the optimal operation results from a compromise between profit and risk. It is shown that under quite general assumptions the reliability program enjoys a concavity property that allows the application of an efficient solution algorithm. An extension of the results to the multi-reservoir case as well as to problems characterized by additional storage and/or outflow constraints or by operating rules looks possible. (Bell-Cornell) W76-05508

ENVIRONMENTAL CONSIDERATIONS IN RIVER BASIN PLANNING AND DECISION

Arizona Univ., Tucson, Inst. of Renewable Natural Resources. M. M. Fogel.

Working Paper No 5, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 16 p,

Descriptors: *River basin development, *Decision making, *Environmental effects, *Planning, Pro-

jects, Ecology, Assessment, Economics, Social aspects, Forecasting, Downstream, Water utiliza-

Identifiers: Impact analysis, Developing countries, Environmental quality.

Decisions to implement river basin projects should be based not only on economic feasibility but also on the impacts the project may have on the environment. The effects of water resources projects are felt in the area of impoundment (if dams are built), downstream from impoundment and/or diversion and in the areas where the water is used. Ecological impacts including technical, economic and social considerations should be assessed and evaluated for all possible alternatives that meet project goals. While the means to measure the physical, chemical and biological parameters of the environment are adequate, the ability to predict the response of whole ecosystems to manipulation is less than adequate. Also, since a framework for assessing the social aspects of a river basin project still needs devising, selection of a preferable alternative is a matter of judgement and of value. Thus, much of the selection process will center on defining the relative utilities of the costs, benefits and the environmental impacts. Decision makers are faced with considering environmental effects either the primary constraint to development as advocated by some leading scientists, or in proportion to public pressure and secondary to engineering and economic con-straints as is done in current practice. As recommended strategies, developing countries should set a high priority on broadening their knowledge and information of the environmental field. They should also integrate environmental planning and regard environmental improvement as one of the multiple objectives of planning. (Bell-Cornell) W76-05510

THE ROLE OF INLAND NAVIGATION IN RIVER BASIN DEVELOPMENT,

Budapest Magyar Tudomanyos Akademia, (Hungary). G. Fekete.

Working Paper No. 7, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 18 p, 2 fig. (United Nations, Department of Economic and Social Affairs)

Descriptors: *River basin development, *Inland waterways, *Navigation, Industries, Water demand, Communication, Economics, National income, Networks, Water transfer.

Identifiers: Water transport, Flow diagram, Socioeconomic results.

The waterway offers as a matter of course two pri-mary pre-conditions necessary for the development in general, and for the settlement of industry in particular: the meeting of water demands and affording large transport capacity. Waterway connections link various regions and thus, over a developing waterway network, interregional trans-port will become possible, creating a unique situation and endowments all over the world for settlement development bringing a new prosperity un-paralleled both in countries directly /riparian/ and indirectly /connected by waterway/ concerned.
The 'environment friendly' nature of water transport is rather well known and its development in-volves a 'chain reaction' in the region or regions concerned, exerting stimulating economic effect on the interlinked waterways, on the attracted zones. A more rational and/or more organized communication by making use of the cheap water transport will result in savings in cost and can con-tribute to the virtual increase of the total national income. Following the 'interdisciplinary logical flow diagram of navigation, the minimization of freight can be achieved and the 'know-how' of legal, administrative, commercial, nautical, technical, economic, etc., preconditions of intraregional and interregional waterway utilization can be readily obtained. (Bell-Cornell) W76-05511

SYSTEMS APPROACH TO RIVER BASIN AND INTERBASIN DEVELOPMENT.

Washington Univ., Seattle. B. W. Mar.

Working Paper No. 9, UNDP/Un Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 13 p, 3 fig. (United Nations, Department of Economic fig. (United Natio and Social Affairs)

Descriptors: *River basin development, *Systems Descriptors: "River basin development, "Systems analysis, Analytical techniques, Control, Design, Planning, Constraints, Resources, River systems, Economics, Hydrology, Dams, Computers, Optimization, Mathematical models, Alternative

planning.
Identifiers: *Interbasin development. Hydro-

Systems approaches to river basin analysis acknowledge the contribution of all known system components and provide a process to identify the relative importance of each component. Complete understanding of any one individual component does not necessarily insure proper system analy-sis, since the neglected or less known components can dominate the system response. Thus detailed knowledge of physical hydrology and geology plus engineer are inadequate to perform comprehensive system studies. Comparable data must be available for economic, demographic, social, political and ecological components of the river asin system to permit adequate analysis. Few individuals have the perception and tolerance to engage in analyses which employ iterative sets of analysis at differing levels of precision and are willing to employ methodologies best suited for these different levels of analyses. Experts with too detailed or too broad a view will create serious delays in such iterative system approaches since they will demand particular levels of precision whether the analysis requires it or not. The major problem in the implementation of the systems ap proach is to obtain consensus among the analyst concerning the resolution of data required, the specific issues to be examined, and the level of system abstraction necessary to address these issues. Herein, various types of systems analysis procedures are classified and examples of their application to river basin development are presented. (Bell-Cornell)

UNCERTAINTY IN WATER RESOURCES DECISION MAKING.

Water Resources Center, Budapest (Hungary). For primary bibliographic entry see Field 6A. W76-05513

A CASE STUDY REPORT ON THE VISTULA RIVER BASIN,

Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.

Working Paper No. 11, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 19 p, 1 fig, 1 tab, 8 ref. (United Nations, Department of Economic and Social Affairs)

basin development *Water manage-*River Descriptors: :Comprehensive planning, *Water manage-ment(Applied), *Control, Evaluation, Investment, Projects, Water supply, Flood control, Water pollution control, Multiple-purpose reservoirs, Simulation analysis, Optimization, Streamflow, Methodology, Economic feasibility, Mathematical

models, Systems analysis.
Identifiers: *Vistula River Basin(Poland),
Developing economies, Target demand concept, Multiobjective planning.

This paper is concerned with the planning strategy adopted for preparation of the UNDP/UN Special Fund Project 'Planning Comprehensive Development of the Vistula River System.' It begins with a

WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Control Of Water On The Surface-Group 4A

brief description of the Vistula River Basin which covers about 54% of the area of Poland. The Basin is a region of rapidly developing economy with a large number and variety of problems confronting water management. Discussion of planning strategy covers such topics as the spatial and problemoriented decomposition of the system, identification of water control objectives, and application of mathematical modeling techniques for evaluation matternatical modeling techniques for evaluation of the alternative water resources development (investment) programs. Finally, some comments on the target demand concept and possibilities of streamflow synthesis are offered. (Bell-Cornell) W76-05514

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THE OUT-OF-KILTER ALGORITHM AND SOME OF ITS APPLICATIONS IN WATER RESOURCES,

Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering. For primary bibliographic entry see Field 6A. W76-05515

RIVER BASIN MODELS AND THEIR APPLICA-

TION WITH SCARCITY OF DATA.
World Meteorological Organization, Geneva (Switzerland).

(Switzerland).
Working Paper No. 13, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 11 p, 1 tab, 12 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *River basin development. Descriptors: *River basin development, *Mathematical models, Hydrology, Planning, Operations, *Data acquisition, Networks, Design, Management, Forecasting, Reservoirs, Hydraulic structures, Systems analysis, Model studies. Identifiers: *Data scarcity, Interbasin development, Conjunctive design.

The activities and system of work of the World Meteorological Organization (WMO) in the field of hydrology and water resources are briefly sum-marized. The importance, changing needs and new trends in the use of water data are reviewed. Potential river basin and interbasin development should not be postponed until more data are col-lected; the essence of a river model is to permit reaching a solution with the limited data available. reaching a solution with the limited data available.
The latest sophisticated planning and operational
models used in water resources development are
in trouble because of the lack of basic data needed
to calibrate the models' parameters, to evaluate
the performance of the model, and to test the effectiveness of the river basin development projects. The influence of improved methods of data acquisition on the development of river basin models is discussed together with a brief review of WMO published guidance material describing the objectives and practice of hydrological network design and the principles of conjunctive design of various kinds of networks. The use of river basin models in water resources management and in hydrological forecasting is discussed with an analnyorological forecasting is discussed with an analysis of the problems arising between the interests of the water user and the operational water requirements of reservoir and related hydraulic structures. The WMO project on the intercomparison of conceptual models used in operational hydrological forecasting is described also. (Bell-Cornell) Cornell) W76-05516

A REVIEW OF SOME HYDROLOGICAL STU-DIES REQUIRED IN THE DESIGN OF WATER MANAGEMENT PROJECTS. World Meteorological Organization, Geneva

Working Paper No. 14, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 7 fig. 2 tab, 7 ref.

Descriptors: *Water resources, *Management, *Design, *Hydrologic data, *Projects, Operations research, Estimating, Water supply, Evaluation, Probability, Time series analysis, Reservoir storage, Flow, Volume, Duration curves. Identifiers: *Reservoir capacity.

Hydrological and related meteorological data are collected to provide information for developing and managing the water resources of a country as well as for operational purposes and research. There is therefore an immediate need to plan and establish data networks of minimum acceptable density. Guidance material on the planning and establishment of data networks has and continues establishment of data networks has and continues to be published by the World Meteorological Organization. This paper reviews the various methods used in the estimation of the available water supplies of a project. The factors to be evaluated in a surface water supply study are listed. Synthesis of hydrological data involving tests of project adequacy and operation using a probabilistic approach and the time series approach are reviewed. Graphical presentations describing the approach, such as duration curves, volume-duraapproach, such as duration curves, volume-dura-tion-frequency curves, low-flow-frequency approach, such as duration curves, volume-dura-tion-frequency curves, low-flow-frequency curves, and volume-discharge-frequency curves are reviewed. In the time series approach, the sequential order of the flows is considered in addition to their probabilities. In the use of this ap-proach, for the analysis of water yield, both the cumulative sums method and the simulated time series method are briefly described. Estimation of the required reservoir storage capacity involves water supply-draft-storage studies. Again, both the probabilistic approach and the time series approach are reviewed. An example is given with a table of probabilities for the various contents of the reservoir, and the use of storage draft relationships to find the optimal reservoir capacity is described. (Bell-Cornell) W76-05517

RECENT TRENDS IN WATER QUALITY MANAGEMENT AND PROTECTION IN HUN-

Water Pollution Control.
For primary bibliographic entry see Field 5G. W76-05518

WATER RESOURCES DEVELOPMENT IN THE TISZA RIVER BASIN AND ITS IMPACT ON SOCIO-ECONOMIC GROWTH,

Water Management Center, Budapest (Hungary). Dept. of Long Range Planning. I. Z. Ballo, and I. Orloczi.

Working Paper No. 16, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 27 p, 5 fig, 5 tab, 12 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: "Water resources development, "River basins, "Land use, "Water management(Applied), "Water supply, "Planning, Economics, Social aspects, Surface waters, Human population, History, Floods, Irrigation, Water pollution control, Water demand. Identifiers: "Tisza River basin(Hungary), "Developing economics, Impact, Socioeconomic rowth Catchments, International conperation

growth, Catchments, International cooperation.

A brief review is presented of the fundamental water management conditions related to land use in the Tisza River Basin, an area of great economic importance to Hungary. The time horizon surveyed comprises two centuries: from 1800 to 2000. The past, present and future socio-economic significant processing the conditions of the nificance of the Hungarian part of the Tisza Valley is emphasized. The main stages, characteristics, problems, and results of the past 150 years' long history of increasingly complex water management are surveyed. Taking into consideration the projections for the Hungarian part of the basin presently available and the development predicted

for the neighboring countries in the catchment, an attempt is made at estimating the needs likely to be attempt is made at estimating the needs likely to be raised by the growing population and the developing economic life in the region. The technico-economic and political measures outlined broadly are potential solutions to the problems formulated. Reference is made to the co-operation of the five CMEA neighboring countries and the work started is expected to provide novel experiences for the integrated development of other international river basins of the World in the near future. (Bell-Cornell) W76-05519

VIEWS ON RIVER BASIN DEVELOPMENT IN

THAILAND, Bangkok Metropolitan Water Works Authority B. Binson

Working Paper No. 18, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 18 p, 2 fig, 4 tab, 5 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *River basin development, *Water resources, Agriculture, Economics, Flood control, Planning, Projects, Reservoir storage, Hydrologic data, Water allocation(Policy), Environment, Hydroelectric power.
Identifiers: *Thailand, Developing countries, Mul-

tiple purpose

The economy of Thailand is characterized by agriculture; development of agroindustry is another aspect towards which the country is moving. Development of water resources is of utmost ing. Development of water resources is of utmost importance in reaching the desired objectives. Following the energy crisis, development of hydropower must be given special attention but should be in pace with other aspects, such as irrigation. This opportunity cannot be fully seized as yet due to the economic handicaps and the war situation in neighboring countries. Nevertheless, progress in water resources development is considered to be satisfactory, even though the scarcity of capital for investment places constraints on achieving integrated water resources development and reflects. tegrated water resources development and reflects on the planning strategies. Efforts are being made to improve outputs of projects and increase farto improve outputs of projects and increase far-mers' income through various means such as edu-cation, expansion of irrigation distribution systems, increase of multi-purpose co-operatives, and land consolidation measures. In the face of capital constraints and the increasing need for food and fibre, careful planning, design, and evaluation of projects are necessary. The planning of water resources in Thailand now takes full acof water resources in Thailand now takes full ac-count of social, economic and environmental aspects. In terms of the desirable goals and pur-poses for development, systems analysis seems an attractive tool for the planning of river basin development. Tremendous progress can be made and unprecendented benefits realized as soon as peace in the region is restored. (Bell Cornell) W76.05520 W76-05520

GOALS AND FORMS OF CO-OPERATION AMONG COUNTRIES FOR THE DEVELOP-MENT OF INTERNATIONAL RIVER BASINS, Research Inst. for Water Resources Development,

Budapest (Hungary).

B. Csermak.

Working Paper No. 19, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1976. 14 p, 10 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: "Water resources, "River basin development, "Water management(Policy), Benefits, Water law, Governments, Planning, Water quality, Water utilization. Identifiers: Developing countries, *International

cooperation.

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control Of Water On The Surface

The purpose of international cooperation on water problems is to create advantageous conditions for water management activities and to facilitate the exploitation of benefits accruing from the international division of labor. The essence of water management could be defined as an activity aimed at an optimal coordination and harmonization of the natural household of water resources with the needs of the society by means of planned scientific, technical, economic, administrative and legal measures. The most effective method of resolving international water management problems is the direct cooperation based on bilateral or multi-lateral agreements between the parties concerned. In order to avoid disputes and to establish a peaceful, fraternal milieu for negotiations, agreements should be based on principles codified in international water law. As a first step for the preparation of codification, it would be most desirable if the UN would decide to: (1) review and modernize its most valuable work published in 1963 under the title, 'Legal Problems Relating to the Utilization and Use of International Rivers;' and on the basis of this work (2) prepare a recommendation on the forms and contents of agreements on international water problems to be accepted by the govern-ments (Bell-Cornell) W76-05521

LINE MOTION AND WATER CURRENT DISC SENSOR.

Office of the Secretary (Navy), Washington, D. C. (Assignee). For primary bibliographic entry see Field 7B. W76-05539

FLOWMETER FOR AN OPEN AQUEDUCT, Yamatake-Honeywell Co., Ltd., Tokyo (Japan).

For primary bibliographic entry see Field 7B. W76-05540

WATER LINE, Uniflex S.P.A., (Italy). (Assignee). For primary bibliographic entry see Field 3F. W76-0554

GROUND WATER IS THE ONLY REAL RESERVE THIS COUNTRY HAS. For primary bibliographic entry see Field 4B. W76-05567

QUURM - A REALISTIC URBAN RUNOFF MODEL, Queen's Univ., Kingston (Ontario). For primary bibliographic entry see Field 2A. W76-0557.

PRECIPITATION MANAGEMENT FOR RECLAMATION OF OVERGRAZED AREAS IN ARID AND SEMI-ARID REGIONS, Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 2B.

SUPPLY AND DEMAND IN WATER PLANNING: STREAMFLOW ESTIMATION AND CONSERVATIONAL WATER PRICING, Kentucky Water Resources Research Inst., Lexington

For primary bibliographic entry see Field 6D. W76-05607

W76-05603

PLAN FORMULATION AND EVALUATION STUDIES--RECREATION. VOL. II OF V. ESTI-MATING INITIAL RESERVOIR RECREATION USE

Army Engineer District, Sacramento, Calif. For primary bibliographic entry see Field 6B. W76-05611 THE HYDROLOGIC POTENTIAL OF UNIT AREAS: A BASIS FOR MANAGING WATER RESOURCES, Forest Service (USDA), Berkeley, Calif., Pacific

Forest Service (USDA), Berkeley, Calif., Pacific Southwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D. W76-05620

FLOOD HAZARD ANALYSES: BUFFALO RIVER, AMHERST COUNTY, VIRGINIA. Soil Conservation Service, Richmond, Va. September 1974. 14 p, 6 fig, 22 plates, 2 tab.

Descriptors: Floods, *Flood profiles, *Hurricanes, *Flood plains, *Flood protection, *Flood plain zoning, Runoff, Flooding, Maximum probable flood, Historic floods, Flood data, Peak discharge, Control structures, *Virginia.

Identifiers: *Buffalo River(Va), Hurricane Camille, Hurricane Agnes, 100-year flood, 50-year flood.

The Buffalo River rises on the eastern slope of the Blue Ridge Mountains and slopes at an average of 18 ft/mi through the 18 mi long study area. Drainage at the upper and lower limits of the area are 16 and 95 sq mi respectively. Prior to 1969 the largest flood had a flow of 20,000 cubic feet per second 1943 and 1944. In 1969 Hurricane Camille dumped rainfall estimated at 15 inches in 8 hours on the watershed causing a peak discharge of 45,000 cfs, much larger than a 100-year flood. Normal annual precipitation is 45 inches. Hurricane Agnes in 1972 produced a peak discharge of 36,000 cfs. Both floods caused damage in the study area, though land use is limited in its development. Most of the watershed is woodland (74%) or pasture (24%). To estimate future floods, peak discharges were determined by flood routing using computers. These discharges were correlated with stream gage records and retarding structures were simulated to show the effect on flood peaks. Hurricane Camille was used as a base. Five categories of uses are suggested and for each the degree of required protection is stated. Power installations, emergency facilities, etc. require maximum protection whereas low-value cropland requires the minimum of protection. The locations of temporary of protection. The locations of temporary benchmarks installed for the study are included. Permanent benchmarks should be installed where they are used frequently for determining limitations of the 100-year flood zone, the Hurricane Camille flood area and limits of the protected area if a proposed flood control project is built. These zones are delineated on accompanying maps. (Smith - North Carolina) W76-05643

FLOOD HAZARD ANALYSES: BLACKS RUN-COOKS CREEK, ROCKINGHAM COUNTY AND HARRISONBURG, VIRGINIA.

Soil Conservation Service, Richmond, Va. September 1974. 22 p, 8 fig, 31 plates, 1 tab.

Descriptors: Floods, *Flood profiles, *Floodways, *Flood plains, *Land use, *Bench marks, *Flood protection, *Flood plain zoning, *Floodproofing, Runoff, Maximum probable flood, *Virginia.

Identifiers: 100-year flood, 500-year flood, Harrisonburg(Va), Blacks Run(Va), Cooks Creek(Va), Park View(Va), Dayton(Va).

Population in the watershed of this study was 12,000 in 1949 and in the past 25 years has increased 60%. The drainage area of the two creeks is 43 sq mi. Cooks Creek is a tributary of Blacks Run which rises near Park View and flows south through Harrisonburg. Because development has increased the amount of land which is impervious to water, volumes and peak flows of floods have increased so that some older bridges and culverts are now inadequate. The trend is expected to continue and this study makes assumptions about land coverage 10 to 15 years from now to anticipate fu-

ture runoff. In 1949 a large flood caused 3 ft of water in downtown Harrisonburg. Losses from lesser floods have been limited to agricultural, road and bridge damages. To predict future floods, physical parameters, present land use conditions, and peak discharges of storms of varying magnitudes were considered through flood routing with computer facilities. These analyses were correlated with stream gage records and with other available data to establish frequency-discharge relationships in the study area with present land use. Anticipated land use was included in a second computer run. Proposed floodwater retarding structures were not taken into account because it is doubted that they will be built. Predicted flood plains can be located on the ground by using temporary benchmarks set for this study. It is suggested that these benchmarks be made permanent. Five categories of uses or facilities and degree of required protection are outlined. (Smith - North Carolina)

FLOOD PLAIN INFORMATION: ILLINOIS AND MICHIGAN CANAL, ROCK RUN CREEK, THORNE CREEK, JOLIET, ILLINOIS.

Army Engineer District, Chicago, Ill.
Prepared for the City of Joliet, March 1975. 42 p,
27 fig, 14 plates, 7 tab.

Descriptors: *Floods, *Flood profiles, *Flood plains, Streamflow forecasting, Historic floods, Flow duration, Peak discharge, Snowmelt, Obstructions to flow, Flood plain zoning, *Illinois. Identifiers: *Standard Project Flood, *Intermediate Regional Flood, *Illinois and Michigan Canal(II), Rock Run Creek(II), Thorne Creek(II), Des Plaines River(II), Joliet(II).

Areas adjacent to the creeks of this study are residential and commercial and along the Illinois and Michigan Canal there are also industrial properties. Flood plains are not highly developed at present with some industrial property, a municipal sewage treatment plant and a few residences at Rockdale. Population of Joliet continues to rise past the 1970 figure 78,804 an increase of 18% in a decade. The now abandoned canal with a channel width varying from 40 to 160 ft, about-6 ft deep, serves as a drainage area for about 19 sq mi in this vicinity. Thorne Creek, with a steep channel slope, drains 1.63 sq mi while Rock Run Creek drains 14.2 sq mi. Floods occur due to intense rainfall from March to October. Between 1866 and 1974, 18 floods have caused damage in Joliet. In the event of an Intermediate Regional Flood a peak discharge of 600 cfs on Thorne Creek at the I & M canal 2400 cfs on Rock Run Creek at the I & M canal and 2175 cfs at Rock Run Creek: South (at the Des Plaines River including overflows from the canal) are expected. Water velocities of up to 7.12 ft/sec in the channel and 1.81 ft/sec in the overbank are predicted. Floods rise quickly taking about 12 hours to reach peak discharge. In a Standard Project Flood peak discharges of 1550 cfs, 7350 cfs and 8500 cfs are expected on Thorne Creek, Rock Run Creek and Rock Run Creek South respectively. Water velocities up to 10.07 ft/sec in the channel and 2.31 ft/sec in the overbank are possible. Floods may damage residential and industrial areas. Most of the 41 bridges across the creeks and canal would be obstructive to flow. There are no flood control structures. (Smith -North Carolina) W76-05645

SPECIAL FLOOD HAZARD INFORMATION REPORT: HOWELL CREEK BASIN LAKES, ORANGE COUNTY, FLORIDA,

Army Engineer District, Jacksonville, Fla.
Prepared for the Orange County Board of Commissioners, March 1974. 15 p, 1 fig, 4 plates, 1 tab.

Descriptors: *Floods, *Flood plains, *Flood stages, *Flood frequency, *Flood profiles, Surface runoff, Flood forecasting, Aquifers, Groundwater, Lakes, Lake sediments, *Florida.

Identifiers: Orange County(FL), Howell Creek Basin(FL), Coincident frequency method, Orlando(FL), Winter Park(FL), Standard Project Flood, 10 year flood, 25 year flood, 50 year flood, 100 year flood, Stage frequency relation, Stage duration relation, Rainfall frequency relation.

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The Howell Creek basin drains about 50 sq mi of The Howell Creek basin drains about 50 sq mi of Orange County and encompasses the suburban areas of Maitland, Winter Park and the northern half of Orlando. High levels in the 69 lakes for which data are presented have caused flooding in the Howell Creek basin. Evaluations of the extent and severity of the 10, 25, 50 and 100 year floods and the Standard Project Flood are presented. Development now exists in the flood plain and a greater demand for building sites within the flood plain is expected as development of the area continues. Factors influencing lake stage include rain, evaporation, surface inflow, surface outflow, and the quantity of groundwater inflow and outflow the quantity of groundwater inflow and outflow which is determined by the relative levels of the lake and the adjoining water table, and by the physical characteristics of the lake sediments and the groundwater aquifer. Since the available lakestage data are not adequate for a conventional frequency analysis, a 'coincident frequency' method was adopted for stage frequency determination. This method involves superimposing an incremental increase in lake stage due to surface runoff on an antecedent lake stage determined from stage duration curves, and determining the joint probability of various combinations of these. Variables used to determine a stage frequency relation by this method are (1) stage duration rela tion (2) rainfall frequency relation and (3) the ratio of lake surface area to impervious drainage area (roofs and pavements). (Henley - North Carolina) W76-05646

FLOOD PLAIN INFORMATION: COASTAL AREAS, LEVY COUNTY, FLORIDA. Army Engineer District, Jacksonville, Fla. Prepared for the Board of County Commissioners of Levy County. June 1973. 31 p, 8 fig, 26 plates, 3

Descriptors: *Floods, *Tides, *Hurricanes, *Flood plains, *Flood profiles, *Tidal waters, Winds, Historic floods, Flood peak, Warning systems, *Florida.

Yankeetown(FL), Storm tides, Gulf of Mexico, Standard Project Tidal Flood, Standard Project Hurricane, Intermediate Regional Tidal Flood, Intermediate Regional Hurricane.

Levy County on Florida's west coast about 100 miles north of Tampa (population 12,756) has 50 miles of coast with flood plains which extend in-land as much as 10 miles. The sparsely developed flood plain contains residences, businesses, roads and a sewage treatment facility in the vicinity of Cedar Key and Yankeetown. Future development is expected to be limited due to the extensive swamps and marshes although both cities are growing. Freshwater floods from intensive rainfall occur in the interior area and adjacent to the Suwannee River. Hurricanes which cause tidal flood-ing can occur from June to October but are most likely in September and October. On 12 occasions since 1920 a hurricane has passed within 50 miles of Levy County. Five tidal floods have occurred since 1935. High winds and tidal flooding from Hurricane Agnes in June 1972 caused \$750,000 damage. Tides reached 8 ft above mean sea level. damage. Hoes reached 81 above mean sea level. Tides during the Intermediate Regional Tidal Flood would reach 16.5 and 21 msl, respectively, with flood levels decreasing at the rate of about 1 t/mi as the flood level moves inland. The IRF would flood 1,000 developed acres and 700 structures. SPF would flood 1,500 developed acres and 750 attractives. The Latency of the Residuel Husting The Acres of the Residuel Husting The Resi 750 structures. The Intermediate Regional Hurricane would have a central pressure of 27.5 inches and maximum winds of 103 mi/hr. The Standard Project Hurricane would have a central pressure of 27.25 inches and maximum winds of 110 mph. (Henley - North Carolina)

W76-05647

FLOOD PLAIN INFORMATION: LITTLE MC-MULLEN CREEK, JESUP, GEORGIA.

Army Engineer District, Savannah, Ga. Prepared for the City of Jesup, Georgia. June 1971. 46 p, 30 fig, 21 plates, 13 tab.

Descriptors: *Floods, *Flood plains, *Flood profiles, *Flood damage, *Flow characteristics, Storms, Hurricanes, Historic floods, Flood frequency, Peak discharge, Warning systems, Flood stages, Channels, Channel improvement, *Geografic

Identifiers: Jesup(GA), Little McMullen Creek(GA), Wayne County(GA), Coleman Branch(GA), Millikin Bay(GA), Penholoway Creek(GA), Standard Project Flood, Intermediate Regional Flood.

Little McMullen Creek has two main tributaries, Coleman Branch and Millkin Bay. A tributary of Penholoway Creek, Little McMullen Creek with a drainage area of 23 sq mi has a relatively flat slope and a channel which averages 4 ft in width and is 4 ft deep. Subdivisions are being constructed along and near Little McMullen Creek. Millikin Bay is located in the more highly developed area of Jesup; Coleman Branch flows through a wide, swampy flood plain. It has only a few buildings in the flood plain. Bridges, culverts, sand and silt deposits, and vegetation can obstruct flood flows Floods can occur at any time of the year as the result of thunderstorms and rainstorms but are most likely to occur in late summer and fall as the result of hurricanes. There have been three major floods since 1898. The Intermediate Regional Flood and the Standard Project Flood would have peak discharges of 3,250 and 8,100 cubic ft/sec respectively at the mouth of Little McMullen Creek. Overbank and channel velocities would reach 1 and 11 ft/sec respectively during IRF, with 26 buildings and 1,057 acres flooded. Water would rise 6 ft in 12 hours and remain above bankfull for 30 hours. SPF would flood 1.407 acres and 62 buildings and would rise 7 ft in 24 hours, remaining above bankfull for 72 hours. (Henley - North Carolina) W76-05648

CRITERIA FOR EVALUATION OF SOCIAL IM-PACTS OF FLOOD MANAGEMENT ALTERNA-

Institute of Public Administration, New York. For primary bibliographic entry see Field 6B. W76-05653

WATER'S MOST EFFICIENT SYSTEM. For primary bibliographic entry see Field 6C. W76-05655

A RURAL MISSISSIPPI SUCCESS STORY: AL-CORN COUNTY'S WATER SYSTEM. For primary bibliographic entry see Field 6D. W76-05657

EFFICIENCY IN WATER QUALITY CONTROL FOR THE WILLAMETTE RIVER, Oregon Univ., Eugene. Dept. of Economics

For primary bibliographic entry see Field 5G. W76-05658

PROPOSAL FOR A TRANS-MEDITERRANEAN AQUEDUCT, Ottawa Univ. (Ontario).

I. G. Debanne.

Technology Review, Vol. 78, No. 1, p 48-55, October-November 1975. 1 fig, 2 tab.

Descriptors: *Water supply, *Water distribu-tion(Applied), *Water resources development, *Electric power, *Aqueducts, Hydraulic struc-tures, Europe, Africa.

Identifiers: France, *Rhone River(France), Algeria, Tunisia, *Trans-Mediterranean Aqueduct.

The increase in oil prices has made it feasible to examine the possibilities and costs of ducting the Rhone River from France to drought-stricken North Africa in exchange for fossil fuels. Three schemes of ducting an average river with flow rates of 20,000 cfs and 40,000 cfs across the Mediterranean are proposed. One proposal includes a 500 mile aqueduct, 150 ft in diameter, made of rubber or rubber-like plastic placed on the sea bottom at a depth of 8400 ft, maintained by cement ballasts. A deep water solution would provide the shortest distance and increase the hydro-static pressure. The advantages of a shallow water aqueduct, although 300 miles longer, would be greater accessibility, lower costs and lower hydrostatic pressure. The head generated by flow is recoverable at the downstream end and usable as hydraulic energy providing energy savings equivalent to 2000 million barrels of oil. The trans-Mediterranean aqueduct operations could be ac-companied by an energy swap whereby France would receive 100 million barrels of oil a year and Algeria and Tunisia would reduce their consumption. Physical constraints such as pressure, sedi-mentation, buoyancy, sea current, and hydrostatic pressure differential are identified and solutions posed. A cost estimate was made on basis of such materials and power needed to move the water. Construction costs depend on technology availa ble and were calculated using the gas and oil pipeline method. The cost-study deals with a 1400 fathom deep aqueduct. The aqueduct would provide economic benefits, minor ecological costs, reduce political confrontations and help balance payments. (Salzman-North Carolina) W76-05660

URBAN WATER MANAGEMENT OF AN INTERNATIONAL RIVER: THE CASE OF EL PASO -JUAREZ,

University of Western Ontario, London. Dept. of Geography.
For primary bibliographic entry see Field 3D.

W76-05661

FLOOD ROUTING IN CHANNEL SYSTEMS WITH ALLOWANCE FOR BANK REGULA-

Latvian Scientific Research Inst. of Hydraulic Engineering and Reclamation, Jelgana (USSR). A. A. Zivert, and V. P. Khelmanis.

Soviet Hydrology, Selected Papers, No. 6, p 560-567, 1973. 4 fig, 17 ref. Translated from Water Resources (Vodnyye resursy), No. 6, p 118-126,

Descriptors: *Model studies, *Flood routing, *Flood forecasting, Mathematical models, Computer models, Computer programs, Floods, Bank storage, Groundwater, Flood plains, Rivers,

*Tverets Identifiers: River(Latvian SSR) *Latvian SSR, *USSR.

The results of computations of the propagation of the release wave in the Tverets River and practical experience in the use of a mathematical model of the storage type for forecasting the future flood regime of major rivers of the Latvian SSR showed that the proposed simplified method for computing the modification of flood waves in channel systems is applicable under conditions when water exchange between the channel and the flood plain has a significant effect on the flow regime and when the inertial terms of the dynamic equation can be disregarded. Under these conditions, the proposed method has the following advantages: (1) The preparation of morphometric and hydraulic characteristics of river channels from hydrometric and topographic data is simplified. In addition to field observations, hydraulic simulation can be used for channels with complex flood plains and with planned hydraulic installations; (2) Because

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control Of Water On The Surface

the computation method is simplified, it is possible to compute complex branching and linked channel systems without particular mathematical compli-cations; (3) Flood wave modification can be computed with allowance for bank storage. The examined method of simulating floods in channel future flood regime in relation to the banking and regulation of channels, and the construction of flood-control reservoirs and other hydraulic installations. (Sims-ISWS) W76-05668

ALLOWANCE FOR PRECIPITATION AND RU-NOFF FLUCTUATION PATTERNS IN COM-PUTING WATER WITHDRAWAL FOR IR-RIGATION SYSTEMS IN THE SOUTHERN

Ukrainskii Nauchno-Issledovatelsi Gidrometeorologicheski Inst.(USSR).

I. A. Zheleznyak.

Soviet Hydrology, Selected Papers, No. 6, p 504-511, 1973. 2 fig, 6 tab, 11 ref. Translated from Trudy Gossudarstvennogo Gidrologicheskogo Instituta, No. 208, p 143-152, 1973.

*Runoff, *Irrigation. *Precipitation(Atmospheric), Water allocation(Policy), Water resources, Water sources, Rivers, River flow, Streamflow, Water level fluctuations, Variability, *Withdrawal, Irrigation practices, Water requirements, Agriculture, Hydrology, Meteorology. Identifiers: *USSR, *Ukraine.

Because of the continuous increase in water utilization in the southwestern part of European USSR, it has become very important to improve the accuracy of determination of water resources and water withdrawal in the basins of the major rivers of the region: the Danube, Dniester, Southern Bug, Dnieper, and Northern Donets. This can be done not only by determining the various runoff and water utilization characteristics more reliably, but also by allowing for the patterns of fluctuation of hydro-meteorological phenomena. The fluctuations in the runoff of the major rivers of the Ukraine and Moldavia and in precipitation are very asynchronous in irrigation zones. Allowance for this phenomenon in drawing the water-management budget of rivers may sig-nificantly reduce the total water withdrawal for irrigation. (Sims-ISWS) W76-05675

ESTIMATE OF THE EFFECT OF FLOOD-PLAIN DRAINAGE ON THE ANNUAL AND MAXIMUM RUNOFF OF SMALL RIVERS IN THE UKRAINE (DNIEPER BASIN),

G. P. Kubyshkin.

Soviet Hydrology, Selected Papers, No. 6, p 511-517, 1973. 7 tab, 9 ref. Translated from Trudy Gos-sudarstvennogo Gidrologicheskogo Instituta, No. 208, p 213-221, 1973.

Descriptors: *Runoff, *Drainage effects, Rivers, Bogs, Wetlands, Flood plains, Basins, River basins, Drainage, Reclamation, Land use, Agriculture, Estimating, Forecasting.

Identifiers: *USSR, *Ukraine, *Dnieper River basin(USSR).

The effect of bog drainage on the surface runoff of rivers under reclamation in the Poles'ye and the forest-steppe of the Ukraine (Dnieper basin) can be estimated reliably from a comparison of the ru-noff of these rivers with that of control rivers over synchronous periods before and after drainage. It is necessary to use several methods of comparison for these two periods after first analyzing the quality of the initial meteorological and hydrologic information. When comparing runoff data before and after drainage, allowance should be made for the nature and magnitude of variations of climatic factors in the drainage basin under study and in control basins, and for the effect of human activity

on runoff: artificial regulation, water withdrawal on runoff: artificial regulation, water withdrawal for industrial and domestic needs, agricultural practices in the dry farmed part of the basin, etc. The drainage and agricultural reclamation of the flood-plain bogs of the Ukraine, which are located in the lower or middle parts of basins (without confined groundwater), caused the following decrease in the surface runoff of the small tributaries of the In the surface runoff of the small tributaries of the Dnieper (with drainage areas of 200 to 10,000 sq km): a decrease of 20-30% and 30-50% in annual runoff and of 20-40% and 40-60% in maximum runoff in the Poles'ye and the forest-steppe of the Ukraine, respectively. (Sims-ISWS) W76-05676

WATER AND ITS ROLE IN THE WORLD (WASSER UND WAS ES IN DER WELT DAMIT

AUF SICH HAT), For primary bibliographic entry see Field 6D. W76-05739

DEVELOPMENT AND FIELD TESTING OF A BASIN HYDROLOGY SIMULATOR,

Texas Univ. at Austin. Dept. of Petroleum Engineering. For primary bibliographic entry see Field 2A. W76-05745

WATER MANAGEMENT CONTROL SYSTEM FOR THE ZAGYVA-TARNA RIVER BASIN. National Water Authority, Budapest (Hungary).

A. Salamin. Working Paper No. 21, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 16 p, 3 fig, 3 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *Water management(Applied), *River basin development, *Control, Hydrology, Meteorology, Data collections, Telemetry, Floods, Planning, Reservoirs, Water demand, Economics, Water pollution control, Timing, Costs, Reliability, Data processing, Runoff, Forecasting.
Identifiers: *Zagyva-Tarna River basin(Hungary),

Multiple objective, Information system, Telemechanical data collection, Developing coun-

In the Zagyva-Tarna basin, the flood protection, the fulfillment of the rapidly growing industrial and drinking water demand, and the daily duties of water management supervision and operation all need numerous, reliable and rapid informations. The informations needed are essentially of hydrological and meteorological character; however, the measurement of the parameters of water quality and the knowledge of the operating condition and the remote control of the main regulating structures will be necessary as well. To solve the complex water management tasks on the Zagyva-Tarna basin, the goal is to establish a multiple-purpose information system in which the immediate processing and store of the basic data, collected automatically and quickly by a high grade of accuracy and by suitable density, is assured in the most favorable form from the point of view of access and further detailed processing. It was necessary to time the water management system on the basis of cost and time factors. Phase I includes the telemetry of the data of the most important hydrological and hydrometeorological sensing devices. In Phase II--by means of the gradual realization of the reservoir system--the flow regu-lation based on telemetry will be achieved. (Bell-Cornell) W76-05746

REAL-TIME MANAGEMENT OF WATER-RESOURCE SYSTEMS,

Thames Water Authority, Reading (England).
Operational Research Unit. For primary bibliographic entry see Field 6A. W76-05747

EX-POST EVALUATION OF RIVER BASIN DEVELOPMENTS IN PAKISTAN,

Arizona Univ., Tucson. For primary bibliographic entry see Field 6A. W76-05748

THE CZECHOSLOVAK WATER DEVELOP-MENT PLANNING APPROACH AND ITS AP-Ministry of Forest and Water Management,

Prague (Czechoslovakia). For primary bibliographic entry see Field 6A. W76-05749

THE COLUMBIA BASIN PROJECT REAP-

Central Washington State Coll., Ellensburg. G. Macinko.

Working Paper No. 24, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 18 p, 2 tab, 4 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *Evaluation, *Irrigation systems, *Projects, *Water resources development, Economics, Food abundance, Land use, Agriculture, Farm management, Methodology, Decision making, *Columbia River.

Identifiers: *Columbia Basin Project, Grand Cou-

lee Dam, Ex-post evaluation.

Examination of the evolution of the Columbia Basin Project from its beginnings in the early 1930's to the present reveals its perceived worth has undergone two major reversals. These changing assessments of the project's worth were in-fluenced by technological developments and by broad scale social changes at the national and international levels respectively, and were not primarily the result of features intrinsic to the project itself. In a society subject to social and technological change as dynamic and ubiquitous as that of modern America, water projects whose development period spans several decades are likely to encounter situations difficult or impossible to foresee at the beginning of the development effort. Long-range planning is enormously com-plicated, and, while the broad outlines of the future may be sketched in as aid to present planning, there apparently is little profit to be gained from attempting detailed and highly quantified future projections as the basis for planning efforts. A reappraisal of the Columbia Basin Project suggests that the most useful planning technique for both developed and developing nations may well involve deliberate efforts to severely limit decisionmaking criteria to the most basic fundamentals and to make ex-post evaluation an integral part of project planning. (Bell-Cornell) W76-05750

EVALUATION OF THE EFFECTS OF WATER TRANSFER.

Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 6A. W76-05751

DECISION MAKING AND PLANNING FOR RIVER BASIN DEVELOPMENT,

Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering; and Arizona Univ., Tucson. Dept. of Hydrology and Water Resources. For primary bibliographic entry see Field 6A. W76-05752

INTER BASIN TRANSFER OF WATER RESOURCE CASE STUDY OF INDUS PRO-

JECT, West Pakistan Water and Power Development Authority, Lahore. N. C. Syed.

Working Paper No. 28, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 24 p. 2 fig, 6 tab, 14 ref. (United Nations, Department of Economic and Social Affairs).

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Descriptors: *River basin development, *Interbasin transfers, *Water resources, *Projects, History, Costs, Financing, Technology, Environment, Runoff, Annual, *Irrigation, Canals, Water supply, Riparian rights, Treaties, Watersheds(Basins).

Identifiers: *Indus Project, Developing countries, Pakistan, India, Water disputes.

Water has always been an essential component of economic stability, agricultural efficiency, prosperity, and consequent progress of mankind. Due to this unique importance, water resources have always received special priority in engineering activities. Use of water for irrigated agriculture in the Indus Plains dates back to thousands of years, as this part of the world inherits one of the oldest civilizations. However, a systematic harnessing of the surface water started in the sub-con-tinent around the turn of the nineteenth century. By early twentieth century, the critical period ru-noff in the Indus System had been almost tapped. However, competing water demands from various riparians started mounting. To cope with this, the irrigation engineers resorted to the innovative inter-river transfer of the water to the extent permitted by environments. Though some additional schemes in this respect were thought of sub-sequently, their implementation was considered detrimental to the lower water riparians. In 1947, the sub-continent was partitioned to create India and Pakistan. Being upper riparian, India created a water dispute, which was settled in September 1960 through signing of the Indus Water Treaty. To implement provisions of the Treaty, Pakistan had to construct the Indus Basin Project. Described is the case study in the context of: (1) historic background; (2) option of interbasin transfer in preference to other alternatives; (3) extent and scope of the Project; (4) mode of financeing and cost; (5) execution of the Project, including necessary institutional and other facilities; and (6) technological, environmental, and other aspects of the Project. (Bell-Cornell) W76-05753

TECHNICAL-ECONOMIC PLANNING OF THE GABCIKOVO-NAGYMAROS BARRAGE PRO-JECT FOR THE DEVELOPMENT OF THE CEN-TRAL-DANUBE BASIN,

National Water Authority, Budapest (Hungary).

Working Paper No. 29, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 16 p, 1 tab. (United Nations, Department of Economic and Social Affairs).

Descriptors: *River basin

*Ulanning *Economics, Navigation,

*Acthodology, India development, *Planning, *Economics, Navigation, Water supply, Management, Methodology, Industries, River regulation, Riparian waters, Shipping, Identifiers: Central Danube Basin, Hungary, Czechoslovakia, International projects, *Barrage projects, Cargo, *Danube River.

Over the common Czechoslovakian-Hungarian frontier section of the Danube River, where depths are inadequate and consequently ford crossings are poor, navigation requirements will be satisfied after the realization of the Gabeikovo-Nagymaros Barrage Project. After the commissioning of the Project interesticated are interesting. sioning of the Project, international navigation conditions will be comparable in importance to those of the Iron Gate Project on the Lower-Danube. The possibilities of water supply for industry and for the adjacent towns will greatly im-prove along the affected Danube section. Flood control conditions also will be better. Utilization of the power potential of the river will become more profitable. Along the shores of the reservoirs, large sporting and recreation areas can be created, and the conditions for irrigation in the two countries will be increasingly favorable. In the course of planning, a general method adaptable to international projects has been derived whereby a division of the total cost into 50-50% between the two countries can be achieved, enabling accurate cost allocation. To ease the complicated task of planning, a 33-step Common bi-lateral planning scheme is suggested. This international project serves not only the aims of the two neighboring countries, but it will influence the development of all European countries. (Bell-Cornell) W76-05754

SOCIAL IMPACTS OF INTEGRATED RIVER BASIN DEVELOPMENT ON LOCAL POPULA-

California Inst. of Tech. Pasadena Div. of Humanities and Social Sciences. For primary bibliographic entry see Field 6A. W76-05755

INTERNATIONAL MANAGEMENT OF THE RIVER PLATE BASIN,

University of Western Ontario, London. Dept. of I. C. Day.

Working Paper No. 31, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 41 p, 9 fig, 4 tab, 53 ref. (United Nations, Department of Economic and Social Affairs)

Descriptors: *River development, *Management, Human population, Governments, Coordination, Hydroelectric power, Foreign coun-tries, Industries, Agriculture, Transportation, Discharge(Water).

Identifiers: *Developing countries, *Plate River Basin(South America), International cooperation,

An integrated river-management experiment was undertaken in 1967 in the Plate Basin. New institutional arrangements were created to direct and coordinate initiatives. While joint efforts have not resulted in cooperative programs, they have permitted diplomats and technicians to meet their counterparts in other nations and to discuss a wide range of matters for the first time, including questions with implications beyond the physical basin. Nevertheless, the most important develop-ments pertaining to hydroelectricity and physical integration are occurring outside the program. In the absence of international agreements to divide the energy potential, Argentina and Brazil adopted conflicting hydroelectric programs in the interna-tional reach of the Parana River. Massive national and bilateral water and transport projects are constructed, approved, or being planned. Before the transportation, water resources, and energy transmission integration working groups in the Plate Program finalize their plans, most important physical links between countries and power developments will be completed, aided by international financing. Moreover, there is no interna-tional agreement yet on water quality standards, water diversions, and water-use priorities. Ecological and esthetic consequences of developments have largely been ignored. However, choices are narrowed and the potential for international animosity increases with each dam completed in the international canyon of the Parana, or elsewhere, based on bilateral or unilateral decisions. W76-05756

SIMULATION AS A TOOL IN INTERNA-TIONAL RIVER DEVELOPMENT, Karlsrube Univ. (West Germany). Institut fuer

Wasserbau III.

For primary bibliographic entry see Field 6A. W76-05757

INTERNATIONAL RIVER BASIN COOPERA-TION: SOME FACTORS INFLUENCING AGREEMENT, British Columbia Univ., Vancouver. Westwater

Research Centre.
For primary bibliographic entry see Field 6E.
W76-05758

LEGAL FRAMEWORK OF CO-OPERATION IN THE FIELD OF WATER MANAGEMENT BETWEEN HUNGARY AND HER NEIGHBOR-

ING COUNTRIES, National Water Authority, Budapest (Hungary). For primary bibliographic entry see Field 6E.

LONG RANGE PLANNING OF WATER RESOURCES: A MULTI OBJECTIVE AP-

PROACH, National Water Authority, Budapest (Hungary). Dept. of Water Management Policy. For primary bibliographic entry see Field 6A. W76-05760

FLOOD LOSS MANAGEMENT IN DEVELOP-ING COUNTRIES: A MODEL FOR IDENTIFY-ING APPROPRIATE STRATEGIES,

Victoria Univ. (British Columbia). Dept. of Geog-For primary bibliographic entry see Field 6A.

W76-05761 MULTIPURPOSE RIVER PROJECT PLANNING

IN THE LOWER MEKONG BASIN: A DECI-SION APPROACH, Economic Commission for Asia and the Pacific.

Bangkok (Thailand).

For primary bibliographic entry see Field 6A. W76-05762

WATER RESOURCES DEVELOPMENT IN THE GANGA-GHAGRA INTERBASIN IN UTTAR PRADESH (INDIA),

Central Board of Irrigation and Power, New Delhi (India).

Working Paper No. 42, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 22 p, 1 fig, 4 tab. (United Nations, Department of Economic and Social Affairs)

Descriptors: *Water resources development, *River basins, *Irrigation programs, Agriculture, History, Economics, Social aspects, Ground-water, Surface waters, Canals, Water utilization, Reservoirs, Diversion, Projects, Water supply, Constraints.

Identifiers: *Uttar Pradish(India), *Developing countries, Economic growth, Artificial irrigation, Social welfare, Socio-economic interaction.

Implementation of irrigation schemes results in so-cial and economic growth. In a region where the majority of the population is engaged in agriculture and where rainfall distribution is not timely, the necessity of artificial means of irrigation increases. In Uttar Pradesh the livelihood of 80% of the people is dependent on agricultural activity. The fertile tract of Ganga-Ghagra interbasin occupies one third of the area. The whole-sale dependence of agriculture on the natural precipitation has been during many years a cause for total failure of crops and famine in the interbasin, bringing the economic condition of the people to near bankruptcy in such years. Although mighty rivers flow in this interbasin, either there are no suitable sites for providing storages or else they cannot be utilized in this region, and so a most attractive proposition is to divert their monsoon water and employ it for paddy cultivation. This paper gives the history of irrigation for the interbasin, includ-ing the program and projects for utilization of sur-

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control Of Water On The Surface

face and ground water and their impact on the social and economic growth of the populace. In this interbasin, irrigation by diversion canals, pumped canals, and tubewells have been implemented; the future program is based on past experience. After enforcement of these schemes, it will be possible to feed Uttar Pradesh and to yield surplus food for export, thereby earning the foreign exchange at the turn of the century. An era of progress and prosperity will be ushered in for the region. (Bell-Cornell) W76-05763

MONETARY VALUES OF LIFE AND HEALTH. Tennessee Valley Authority, Knoxville. Flood Control Branch.

For primary bibliographic entry see Field 6F. W76-05812

WATER EXCHANGE

DROUGHT ALLEVIATION,
Colorado State Univ., Fort Collins. Hydrology and Water Resources Program.

K. Takeuchi. Hydrology Papers No. 70, November 1974. 31 p. 6 fig., 3 tab., 16 ref. NSF GK-11564, GK-31521X.

Descriptors: *Water transfer, *Economic feasibility, *Droughts, Water shortage, River basins, Water conveyance, Insurance, Closed conduits, Pressure Reservoirs, conduits, Networks. *Regional analysis.

Identifiers: *Water interchange, Bi-directional conveyance, Drought insurance, Case study.

The physical and socio-economic feasibility of a regional water-exchange concept as an alternative to uni-directional transfer, water storage, water exchange, and drought insurance in alleviating drought problems, are examined. The Federal Crop Insurance Corporation offers insurance against drought hazards, but it is unlikely that a drought insurance program can be expanded to cover anything other than crops on unirrigated lands; however drought insurance for industries and/or municipalities may be realistic. A regional water-exchange system, by using bi-directional water transmission under pressure, can alleviate drought situations by smoothing the regional water surpluses and deficits. Such a network can be established without huge economic investment in large urban areas. By smoothing water supplywater demand imbalances, the need for additional water storage capacities may be significantly reduced and can compensate for the resistance against the construction of large reservoirs. The benefits of an exchange system will accrue to all interconnected regions and thus avoid interregional disputes common in uni-directional water transfers. In order to maximize the substitution effect, the water-exchange system should be ontimally operated by assuming unlimited capacities in the water-exchange lines. The efficiency measure is illustrated by a hypothetical regional water-exchange system which interconnects the Missouri, North and South Platte, Arkansas, Rio Grande, and Colorado Rivers. (Auen-Wisconsin). W76-05819

AND COST ANALYSIS OF HYDROLOGICAL FORECASTS, World Meteorological Organization, Geneva (Switzerland).

For primary bibliographic entry see Field 6B. W76-05823

AN ECONOMIC ANALYSIS OF WATER USE IN COLORADO'S ECONOMY. Colorado State Univ., Fort Collins. Dept. of

For primary bibliographic entry see Field 6B. W76-05837 Economics.

MULTI-ORIECTIVE WATER RESOURCES PLANNING: METHODOLOGY TO ACHIEVE COMPATIBILITY BETWEEN ENVIRONMEN-TAL AMENITIES AND ECONOMIC DEVELOP-

Clemson Univ., S. C. Dept. of Environmental Systems Engineering. For primary bibliographic entry see Field 6B. W76-05840

APPLICATION OF MULTI-REGIONAL PLANNING MODELS TO THE SCHEDULING LARGE-SCALE WATER RESOURCE SYSTEMS DEVELOPMENT. Geological Survey, Reston, Va.

For primary bibliographic entry see Field 6A. W76-05846

STEADY-STATE SEGMENTED DISSOLVED-OXYGEN MODEL, Geological Survey, Bay Saint Louis, Miss.

For primary bibliographic entry see Field 5B. W76-05855

THE 1973 MISSISSIPPI RIVER BASIN FLOOD: COMPILATION AND ANALYSES METEOROLOGIC, STREAMFLOW, AND SEDI-MENT DATA, National Weather Service, Silver Spring, Md.; and

Geological Survey, Reston, Va. For primary bibliographic entry see Field 2E. W76-05860

SOLUTE TRAVEL-TIME ESTIMATES FOR TILE-DRAINED FIELDS: I. THEORY, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering. For primary bibliographic entry see Field 5B.

W76-05904

SOLUTE TRAVEL-TIME ESTIMATE FOR TILE-DRAINED FIELDS: II. APPLICATION TO EXPERIMENTAL STUDIES,

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering. For primary bibliographic entry see Field 5B. W76-05905

DEPENDABLE YIELD OF RESERVOIRS WITH INTERMITTENT INFLOWS.

Agricultural Research Service, Stillwater, Okla. Water Conservation Structures Lab. W. R. Gwinn, and W. O. Ree.

Transactions of the American Society of Agricultural Engineers, Vol. 18, No. 6, p 1085-1088, November-December 1975. 4 fig, 2 tab, 2 ref.

Descriptors: *Reservoir yield, *Rainfall-runoff relationships, *Low flow, *Hydrologic budget, *Reservoir operation, *Oklahoma, Lake stages, Withdrawal, Droughts, Inflow, Runoff, Water yield, Watershed management.
Identifiers: Lake McMurtry(Okla), Black Bear

Creek(Okla), Council Creek(Okla),

A precipitation-runoff relationship for drought periods was developed for grasslands of the Red-dish Prairies in Oklahoma. Data from five watersheds ranging in size from 0.0676 to 1492 sq km were used in the development. Minimum accumulated runoff was expressed as a function of the related precipitation and watershed size for the driest periods on record, ranging in length from 1 to 10 y. The precipitation-runoff relationship and the storage equation were used to determine the dependable use rates of water from a reservoir so that the water level would not drop below a preselected minimum. (Lardner - ISWS) W76-05908 COMMENT MILTIVARIATE HPON SYNTHETIC HYDROLOGY, Centro di Ricerca IBM di Pisa (Italy). For primary bibliographic entry see Field 2A. W76-05909

CORRECTION OF BIAS IN THE ESTIMATION OF THE COEFFICIENT OF SKEWNESS, Institut National de la Recherche Scientifique, Rimouski (Quebec) For primary bibliographic entry see Field 2E. W76-05910

USING PARAMETRIC MODELS OF RUNOFF TO IMPROVE PARAMETER ESTIMATES FOR STOCHASTIC MODELS.

Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2E. W76-05911

DISCHARGE EQUATIONS FOR HS, H, AND HL

Agricultural Research Service, Stillwater, Okla., Water Conservation Structures Lab For primary bibliographic entry see Field 8B.

CONDITIONAL EXPECTED TSUNAMI INUN-DATION FOR HAWAII, Hawaii Univ., Honolulu. For primary bibliographic entry see Field 8B. W76-05920

GEOLOGY AND WATER RESOURCES OF CHARLES MIX AND DOUGLAS COUNTIES, SOUTH DAKOTA, PART I: GEOLOGY, Geological Survey, Vermillion, S. D. L. S. Hedges. Bulletin 22, 1975. 43 p, 23 fig, 2 tab, 42 ref.

Descriptors: *Geologic formations, *Geologic investigations, *Geologic mapping, *Geohydrologic units, *South Dakota, Geologic units, Geologic time, Aquifers, Glacial drift, Groundwater resources, Till, Stratigraphy, Tertiary period, Water resources. Identifiers: Illinoian glaciation, Wisconsinan glaciation, Cretaceous system, Outwash.

Charles Mix and Douglas Counties include an area of about 1,540 sq mi in southeastern South Dakota. The Precambrian Sioux Quartzite underlies the area and is overlain by Cretaceous shales, sandstones, limestones, and marls as much as 1,700 ft thick. Tertiary rocks of Miocene-Pliocene age are about 150 feet thick and are mapped as Ogallala undifferentiated and the Fort Randall Formation. Glacial and non-glacial deposits as much as 100 ft thick mantle the bedrock in the bedrock channels. The major bedrock channels were cut by the White River after it was diverted from its channel north of the study area. The Wagner Formation (new name), a non-glacial western derived fluvial deposit, was deposited by the diverted White River. Large reserves of groundwater and surface water are available for development. Large sand and gravel reserves are also present but accessibility presently limits the development of this natural resource. Present data indicate no signifi-cant metallic or fossil fuel resources in Charles Mix and Douglas Counties. (Sanderson-ISWS) W76-05923

COMPARATIVE ESTIMATE OF ENERGY LOSSES IN BODIES OF WATER, AND QUIET AND TURBULENT FLOWS, For primary bibliographic entry see Field 8B. W76-05924

WATER QUANTITY MANAGEMENT AND CONTROL-Field 4

Control Of Water On The Surface-Group 4A

SNOW ACCUMULATION AND MELTING IN THE FOREST AND IN CLEAR-CUT AREAS IN THE CENTRAL URAL, Vsesoyuznyi Nauchno-Issledovatelskii Institut Lesovodstva i Mekhanizatsii Lesnogo Khozyaist-vs. Byshking (USSP).

va. Pushkino (USSR).

For primary bibliographic entry see Field 2C. W76-05929

HYDRAULIC COMPUTATION OF A POOL HOLLOW, For primary bibliographic entry see Field 2E.

W76-05931

MAPS OF THE ELEMENTS OF THE HYDROLOGIC BUDGET OF ASIA, Akademiya Nauk SSSR, Moscow. Institut Gregrafii.

For primary bibliographic entry see Field 2A. W76-05934

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SOIL MICROBES, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 2G. W76-05935

SOIL PROCESSES AND INTRODUCED CHEMI-

CALS, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4C. W76-05936

DEMAND FOR DISSOLVED OXYGEN EXERTED BY FINELY DIVIDED LOGGING DEBRIS IN STREAMS,

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4C. W76-05939

GEOLOGY AND GEOMORPHOLOGY OF THE H. J. ANDREWS EXPERIMENTAL FOREST, WESTERN CASCADES, OREGON, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D. W76-05941

TIMBER PRODUCTION AND WATER QUALITY -- PROGRESS IN PLANNING FOR THE BULL RUN, PORTLAND, OREGON'S MUNICIPAL WATERSHED, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05942

PESTICIDE RESIDUE DYNAMICS IN A FOREST ECOSYSTEM: A COMPARTMENT MODEL.

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05946

WATER LEVEL GAUGE, Department of the Navy, Washington, D.C. Office of the Secretary.

For primary bibliographic entry see Field 7B. W76-05977

FLOOD-CAUSED TREE MORTALITY AROUND ILLINOIS RESERVOIRS,

Illinois Univ. at Urbana-Champaign. Dept. of

D. T. Bell, and F. L. Johnson. Trans Ill State Acad Sci. 67(1): 28-37. 1974.

Descriptors: *Illinois, *Trees, Reservoirs, Floods,

The effects of high reservoir levels in Rend Lake and Lake Shelbyville, both located in southern Il-linois, on species of the streamside forest are described. Tolerances to growing season inunda-tion for 24 tree species were determined from data on tree elevation and duration of flooding. A limit of 30 days of flooding during spring and summer months is suggested to insure survival of tree vegetation around reservoir margins.—Copyright 1975, Biological Abstracts, Inc.

A NON-ADAPTED VEGETATION INTERFERES WITH WATER REMOVAL IN A TROPICAL RAIN FOREST AREA IN HAWAII.

Hawaii Univ., Honolulu. Dept. of Botany D M Dombois Trop Ecol. 14(1): 1-18. 1973.

Descriptors: Vegetation, *Hawaii, Mulch, Soils, Rain forests, Reforestation, Vegetation establish-

Identifiers: *Andropogon-Virginicus, *Tropical rain forests, Evergreens.

Water retention by Andropogon virginicus mulch on Hawaii soils was investigated. During the rainy season, the grass cover prevents evaporation sufficient to drain the soil. Reforestation with tropical evergreens is recommended to restore proper balance.--Copyright 1974, Biological Abstracts, Inc. W76-06042

ILLINOIS DRAINAGE LAW--THE DOMINANT ESTATE OWNER MAY NOT INCREASE THE RATE OR AMOUNT OF SURFACE WATER RUN-OFF ONTO THE SERVIENT ESTATE BEYOND A RANGE CONSISTENT WITH A POLICY OF REASONABLE USE,

Illinois Bar Journal, Vol 63, No. 8, p. 466-469, 475 (1975), 4 p.

Descriptors: "Reasonable use, "Drainage, "Illinois, "Surface runoff, "Diversion, Legal aspects, Civil law, Surface drainage, Drainage effects, Judicial decisions, Drainage water, Damages, Water law, Watershed management, Adjacent land owners. Identifiers: Servient estate, Dominant estate

Plaintiff servient estate owner brought an action against defendant dominant estate owners for damages arising out of an allegedly illegal increase in surface water run-off onto the plaintiff's land. The plaintiffs contended that this increase was caused by the subdivision of defendants' land into separate lots, and by the diversion of water from sources other than the natural watershed. At trial, both parties agreed that the civil law rule of drainage was applicable although they differed as to the scope of the rule. The defendants contended that it could not be held liable for an increase in surface run-off unless it could be shown that water was diverted from another watershed. The trial court dismissed the plaintiff's claim for failure to prove such diversion. On appeal, the Illinois Supreme Court saw the issue in the case to be whether the civil law rule encompassed increases in surface run-off or whether it was limited to changes in the normal course of drainage. The court determined that the civil rule applies in cases where the run-off increase is in excess of that allowed by the policy of reasonable use. In so hold-ing, the court considerably narrowed an exception to the rule which had allowed a surface run-off increase if 'good husbandry' reasons could be shown. Consequently, since the run-off increase in this case was found to be unreasonable, the decision was reversed. (Hoffman-Florida) W76-06051

LEGISLATIVE BARGAIN AND THE DOCTRINE OF REPEAL BY IMPLICATION (DISCUSSION OF CASE INVOLVING COLORADO RIVER STORAGE ACT).
Colorado Law Review, Vol. 46, No. 2, p. 288-310 (1974). 23 p, 1 map.

Descriptors: *National monuments, *Legislation, Descriptors: 'National monuments, 'Legislation,
*Legal review, Colorado River, Water resources
development, Legal aspects, Judicial decisions,
Federal government, Regulation, Environmental
effects, Water law, Water resources, Rivers,
Running waters, Bodies of water, Conservation,
Water utilization, Water control, Water management(Applied), Economics, Government finance, Budgeting, National parks.
Identifiers: *Colorado River Storage Project Act

of 1956, Repeal by implication, Legislative intent.

The United States Tenth Circuit Court of Appeals The United States Tenth Circuit Court of Appeals in the case of Friends of the Earth v. Armstrong held a section of the Colorado River Storage Project Act of 1956 repealed by implication because Congress had consistently refused to allocate funds to realize the project. The court viewed this legislative history as indicating a significant reversal of the congressional position concerning the project. The author's position, however, is that the lack of activity is the result of a bargain struck between environmentalists and committee membetween environmentalists and committee mem-bers in order to obtain passage of the Act. It does not indicate any implicit repeal of the Act but merely the intention of Congress to delay the realization of the project. Furthermore, it is unforrealization of the project. Furthermore, it is unfor-tunate that the court expanded the doctrine of repeal by implication abrogating this legislative compromise, since the doctrine should be used only when congressional actions show an unequivocal intent to repeal previously enacted legislation. (Nursey-Florida) W76-06052

CONGRESS ORDERS MORITORIUM ON GAR-RISON DIVERSION UNIT.

For primary bibliographic entry see Field 6E. W76-06054

CERTAIN LAND USE REGULATIONS TO PROTECT FROM DANGER OF FLOODING. Nags Head Town Council, Nags Head, N.C. For primary bibliographic entry see Field 6F. W76-06059

SUGGESTED PROVISIONS TO BE USED IN ZONING ORDINANCES FOR COMPLIANCE WITH SECTIONS 1910.3(C) OF THE NA-TIONAL FLOOD INSURANCE PROGRAM. For primary bibliographic entry see Field 6F.

TO AMEND THE WILD AND SCENIC RIVERS ACT (ON S. 10 AND S. 1004). For primary bibliographic entry see Field 6E.

EVALUATION OF ECONOMIC BENEFITS FOR FLOOD CONTROL AND WATER RESOURCE

Corps of Engineers, Washington, D.C. Federal Register Vol. 39, No. 159, p. 29539-29550, August 15, 1974, 12 p.

Descriptors: *Cost-benefit analysis, *Adoption of practices, *Administrative agencies, *Flood control, *Economic prediction, Legislation, Economic impact, Evaluation, Measurement, *Planning, Government, Costs, Financial feasibility, Structures, Flood plains, Federal government, Land use, Cost analysis, Water policy, Water resources development. Identifiers: Administrative guidelines, Department of the Army, Flood Control Act of 1936.

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control Of Water On The Surface

This document sets forth new guidelines issued by the Secretary of the Army, acting through the Corps of Engineers, explaining procedures to be used in evaluating benefits under the national economic development objective for flood control and related water resources planning. Authority for these guidelines stems from the Flood Control Act of 1936 which is directed toward increasing capital and productivity through flood plain management. While there is only one benefit stan-dard, it is applied to three different benefit categoinnundation reduction; intensification; location. Before any evaluation can be made, how-ever, four preliminary steps must be taken: (1) identification of the affected area; (2) estimation of land use demand; (3) determination of flood plain characteristics; and (4) projection of land use. Sensitivity analysis, utilization of sampling techniques and quantification of variable relationships can further improve the credibility of a flood control plan. The guidelines also require, in addition to the cost-benefit study, reports on the break-even years, internal rate of return, discount rate and value per structure. (Jenkins-Florida) W76-06083

EURASIAN WATER-MILFOIL IN MICHIGAN, Auckland Univ. (New Zealand). Dept. of Botany. For primary bibliographic entry see Field 5G. W76-06149

4B. Groundwater Management

GROUNDWATER QUALITY
OF WELL INJECTION OF **OPTIMAL** MANAGEMENT: WASTE WATERS.

Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering. For primary bibliographic entry see Field 5B.

SIPHON SYSTEM YIELDS CHILEAN PLANT

MORE WATER, Universal Oil Products, St. Paul, Minn. Johnson

For primary bibliographic entry see Field 8C. W76-05550

HISTORY OF GROUND WATER CONCEPTS. National Water Well Association, Worthington,

Ohio For primary bibliographic entry see Field 2F. W76-05551

VYREDOX-IN SITU PURIFICATION GROUND WATER,

Stockholm Univ. (Sweden). Dept. of Geology. For primary bibliographic entry see Field 5F W76-05553

AQUIFER EVALUATION USING DEPOSI-TIONAL SYSTEMS: AN EXAMPLE IN NORTH-

CENTRAL TEXAS, Dames and Moore, Boca Raton, Fla For primary bibliographic entry see Field 2F. W76-05554

HISTORY OF GROUND WATER DEVELOP-

National Water Well Association, Worthington, Ohio.

T.E. Gass. Water Well Journal, Vol. 30, No. 2, p. 28-29, February 1976.

Descriptors: "History, "Artesian wells, Legisla-tion, "Water wells, "Groundwater mining, "Drilling, United States, Regulation, Construc-tion, Standards, Government supports. Identifiers: Ancient water wells, Kanats, Water well construction regulations.

The development of ground water removal techniques is discussed. The examples of Jacob's and Joseph's wells are taken from the twenty-sixth chapter of Genesis. The ancient Persian Kanats are explained and their construction methods out-lined. Modern water well drilling techniques are reviewed. The need for standardized regulations governing water well construction in the United States is discussed. (Heiss-NWWA) W76-05556

JUDGING THE AVAILABILITY OF GROUND

The Johnson Drillers Journal, Vol. 47, No. 6, p 4-9, November-December 1975, 4 fig.

Descriptors: *Groundwater mining, *Groundwater resources, Evaluation, Resource allocation, Water quality, Legal aspects; Dewatering, *Groundwater availability, Water conservation, Water policy. Identifiers: Groundwater legal aspects, Groundwater legal aspects, Groundwater legal aspects, Groundwater legal aspects, Groundwater legal aspects. water level decline. Sustained yield concept.

Long term public policy in the area of ground water conservation must be tempered with specific guidelines before adoption. The meaning of ground water conservation and the methods to implement the program must first be decided upon. Policy must be tailored for three generalized modes of occurrence when dealing with ground water resources: water-table aquifers, coastal plain aquifers and artesian aquifers. The concept of optimal development must be used to specifi-cally treat each of the above modes so as to remain consistent with sound values in resource conservation. (Heiss-NWWA) W76-05558

COLORADO CITY SOLVES ITS SAND PUMP-ING PROBLEMS,

Wright Water Engineers, Inc., Denver, Colo. For primary bibliographic entry see Field 8C. W76-05559

CAREFUL SAMPLE TAKING IS KEY TO SUCCESSFUL WELLS.

Universal Oil Products, St. Paul, Minn. Johnson Div. J. R. Carr.

The Johnson Drillers Journal, Vol. 47, No. 2, p 4-7, March-April 1975, 2 fig.

Descriptors: *Logging(Recording), *Drillers logs, Drill holes, Heaving, *Drilling samples, Boreholes, Wells, Drilling fluids, *On-site data collections.

Identifiers: *Borehole fluid behavior, *Borehole Sand pump constant shavings. sampling

Close attention to sample retrieval and accurate logging of samples are discussed. Good well driller samples brought up from the borehole are the best samples brought up from the borenoic are the best means of quality control while drilling a produc-tion well. Borehole heaving, the merits and disad-vantages of various drilling fluids, and new equip-ment available to the drilling contractor also are discussed. (Heiss-NWWA) W76-05560

A DRILLER'S GOOD FRIEND - THE ELEC-TRIC LOGGER.

Universal Oil Products, St. Paul, Minn. Johnson

For primary bibliographic entry see Field 8G.

EFFICIENT WELLS SAVE ENERGY AND REDUCE COSTS.

Universal Oil Products, St. Paul, Minn. Johnson Div

R. L. Schreurs The Johnson Driller's Journal, Vol. 47, No. 3, p. 1-3, May-June 1975, 2 fig. Descriptors: Aquifers, *Storage coefficient, *Water wells, Drawdown, *Transmissivity, *Operating costs, Energy, Cosi comparisons.
Identifiers: *Energy conservation, Water well

operating costs, Water well design.

Efficient water well design and development based on knowledge of hydrologic conditions do much to conserve energy and reduce long term well costs. The terms transmissivity, coefficient of storage and drawdown are defined and used in two examples of well efficiency. Through these examples the cost effectiveness of a properly developed water well versus the poorly developed one is demonstrated. (Heiss-NWWA) W76-05563

PROPER SELECTION OF GRAVEL PACK IS KEY TO SUCCESSFUL WELLS, Universal Oil Products. St. Paul. Minn. Johnson

For primary bibliographic entry see Field 8C. W76-05565

YUKON CITY'S NEW WELL REPLACES FIVE OLDER ONES,

Hydrogeological Consultants Ltd., Edmonton (Alberta) R. J. Clissold

The Johnson Driller's Journal, Vol. 47, No. 3, p. 4-5, May-June 1975, 3 fig.

Descriptors: *Municipal water, Water supply, Water wells, Groundwater, *Canada, Drill holes, Aquifer characteristics, *Water yield improve-

Identifiers: *Groundwater temperature, Heating river water, *Energy cost reduction.

Due to increased water consumption and prohibitive costs of heating river water, the City of Whitehorse drilled five warm water wells between 1955 and 1973. The yield from the five wells (1540 imperial gallons per minute) was not sufficient for projected needs. A sixth well was drilled using results from previous aquifer tests and infra-red photographs. A pilot hole was drilled and cased so as to allow the collection of lithologic samples to provide data for estimates of aquifer parameters and information for ground water temperature. The production well utilized a 16 inch surface casing to 63 feet, 6 feet of 14 inch casing with a lead packer and 20 feet of 200-slot 16 inch telescopic screen. The warm water requirement of 2,700 imperial gallons per minute for Whitehorse is now met by a single source. It has resulted in a savings of \$1,124,000 annually due to the shutdown of the original five wells and cessation of river water heating. (Heiss-NWWA) W76-05566

GROUND WATER IS THE ONLY REAL RESERVE THIS COUNTRY HAS.

The Johnson Driller's Journal, Vol. 46, No. 6, p. 3-4, November-December 1974, 1 fig.

Descriptors: *Water distribution, *Groundwater Descriptions: Water distribution, Grounder recharge, *Water sources, Hydrologic budget, Water circulation, Water supply, *United States, *Groundwater resources, *Groundwater availarecharge,

Identifiers: Geographic distribution(Water).

The distribution of water on the geosphere of earth is discussed; fresh and salt water volumes are ap-proximated and distribution is described in terms of hemispherical geography. Non-saline water sources are quantified and qualified as to their ac-cessibility. Annual natural recharge of ground water in the United States is contrasted against the cumulative recharge of the past 160 years. Future ground water study and development are discussed. (Heiss-NWWA) W76-05567 ERDA'S TIGER LAGOON PROGRAM TO PROBE NEW ENERGY SOURCE. For primary bibliographic entry see Field 8A. W76-05568

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EXPERIMENTAL WELL FIELD IS PUT TO MANY USES, For primary bibliographic entry see Field 8G.

W76-05569

COSTS AS A GUIDE TO PRICING, Sydney Univ. (Australia). Dept. of Accounting. For primary bibliographic entry see Field 6C. W76-05570

EXAMINATION AND REMOVAL OF IRON IN GROUNDWATER, Sunnittelukeskus-MKR, Helsinki (Finland).

For primary bibliographic entry see Field 5B.

SUBSURFACE DISPOSAL OF LIQUID INDUS-

TRIAL WASTES, Department of the Environment. Ottawa (Ontario). Inland Waters Directorate For primary bibliographic entry see Field 5B. W76-05573

HOW STEAM IS PRODUCED AND HANDLED AT THE GEYSERS, For primary bibliographic entry see Field 8C.

W76-05574

CLASSIFICATION METHODS OF GROUNDWATER MANAGEMENT (KLASSIFICAKSIIYA METODOV UPRAVLENIYA REZHIMOM I RESURSAMI PODZEMNYKH VOD), U. M. Akhmedsafin, and F. V. Shestakov. Vestnik Akademii Nauk Kazakhskoy SSR, No. 7,

p 3-13, 1975. 3 tab, 17 ref.

Descriptors: *Groundwater, *Water manage-ment(Applied), *Siphons, *Water supply, Recharge, Water table, Pressure, Water resources development, Hydrology, *Artificial recharge, Water yield improvement.
Identifiers: Groundwater management.

Classification is presented of different methods of groundwater management. Forced or siphon type groundwater capture is widely used for water supply, while the use of explosive or nuclear energy to increase the hydrostatic pressure is in an experimental stage. Artificial recharge is used commonly for water supply in areas with limited water resources. The water table is lowered for ameliorative purpose, to make the extraction of minerals possible, or to prevent the intrusion of sea-water. Groundwater can be displaced to more favorable sites by pressure in air or gases. (Takacs-FIRL) W76-05600

FORECASTING WATER LEVELS IN AQUIFERS BY NUMERICAL AND SEMIHYBRID METHODS, Technion-Israel Inst. of Tech., Haifa. Dept. of

Civil Engineering.
For primary bibliographic entry see Field 2F.
W76-05686

MOVEMENT OF TRACERS THROUGH SOIL, Ontario Ministry of the Environment, Toronto.
Applied Science Section.

For primary bibliographic entry see Field 5B. W76-05701

DEVELOPMENT AND FIELD TESTING OF A BASIN HYDROLOGY SIMULATOR,
Texas Univ. at Austin. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 2A. W76-05745

REVERSE OSMOSIS PLANT HELPS CITY COPE WITH DIMINISHING GROUNDWATER SUPPLY, Dacy (G. H.) Associates, Inc., Miami, Fla.

For primary bibliographic entry see Field 5F. W76-05779

WATER FACTORY 21 IS THE FUTURE, Toups Corp., Santa Ana, Calif. For primary bibliographic entry see Field 5F. W76-05782

NITRATE REMOVAL FROM WATER BY ION EXCHANGE,

Water Research Centre, Medmenham (England). Medmenham Lab. For primary bibliographic entry see Field 5F.

VERTICAL ELECTRICAL RESISTIVITY SOUNDINGS TO LOCATE GROUND WATER RESOURCES: A FEASIBILITY STUDY, Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.

W76-05806

A. Sabet. Available from the National Technical Informa-tion Service, Springfield, Va 22161 as PB-251 393, \$4.50 in paper copy, \$2.25 in microfiche. Virginia Water Resource Research Center, Blacksburg, WRRC Bulletin 73, November, 1975. 64 p, 12 fig, 21 ref.

Descriptors: *Groundwater, *Virginia, *North Carolina, *Coastal plains, *Resistivity, *Feasibility studies, Computer programs, Data collections, Data processing.

Identifiers: Virginia Coastal Plain, *Schlumberger

array, Electric basement, North Carolina Coastal Plain, Vertical Resistivity.

The occurrence of ground water in the Coastal Plain region of southeastern Virginia and northeastern North Carolina, as indicated by the results of 45 vertical resistivity soundings (VES), is discussed. Soundings were taken with the Schlumberger array with a maximum separation of 8,000 feet between the current electrodes. VES 8,000 feet between the current electrodes. VES data interpreted through an automatic computer interpretation program, and by the curve-matching method. The results suggest that, in the area west of the town of Suffolk, the depth to the basement complex can be determined with reasonable confidence. Eastwards from Suffolk, and 'electric basement' of high resistivity was detected at depths which usually exceeded 1,000 feet. The correlation between come VES interpretation and correlation between some VES interpretation and resistivity logs of wells in their vicinities reveals high degrees of similarities. W76-05835

INSTITUTIONAL CONSTRAINTS AND CON-JUNCTIVE MANAGEMENT OF WATER RESOURCES IN WEST TEXAS,

Texas Tech Univ., Lubbock. Dept. of Geography. For primary bibliographic entry see Field 6E. W76-05842

APPLICATION OF MULTI-REGIONAL PLANNING MODELS TO THE SCHEDULING OF LARGE-SCALE WATER RESOURCE SYSTEMS DEVELOPMENT,

Geological Survey, Reston, Va. For primary bibliographic entry see Field 6A. W76-05846

A DIGITAL-COMPUTER MODEL FOR ESTI-MATING HYDROLOGIC CHANGES IN THE AQUIFER SYSTEM IN DANE COUNTY, WISCONSIN, Geological Survey, Madison, Wis. For primary bibliographic entry see Field 2F. W76-05851

EVALUATION OF DATA AVAILABILITY AND EXAMPLES OF MODELING FOR GROUND-WATER MANAGEMENT ON CAPE COD, MAS-

Geological Survey, Boston, Mass.
A. W. Burns, M. H. Frimpter, and R. E. Willey.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 848, \$4.00 in paper copy, \$2.25 in microfiche. Water-Resources Investigations 16-75, 1975. 22 p, 7 fig. 63 ref.

Descriptors: "Groundwater resources, "Saline water-freshwater interfaces, "Computer models, "Hydrologic systems, "Massachusetts, Hydrologic cycle, Groundwater movement, Water supply, Withdrawal, Groundwater recharge, Specific yield, Aquifer characteristics.

Identifiers: "Cape Cod(Mass).

Groundwater is the major source of water for public and private supplies on Cape Cod, Mas-sachusetts. A peninsula in the Atlantic Ocean, Cape Cod is underlain by unconsolidated earth materials that contain a lenslike reservoir of fresh materials that contain a lenslike reservoir of fresh water 'floating' on salty groundwater. Areal and cross sectional computer simulation models based on solutions to the groundwater flow equation demonstrate the interdependence of water-table altitude, recharge, withdrawal, spatial variations and anisotropy of hydraulic conductivity, spatial variations of specific yield, position of the freshwater/salt-water zone of diffusion, and other boundaries. Currently available (1974) descriptions of these parameters, however, are insufficients ooundaries. Currently available (1974) descriptions of these parameters, however, are insufficient to calibrate the models to adequately predict future hydrologic conditions for resource planning and management. (Woodard-USGS) W76-05856

FLORIDAN AQUIFER IN NORTHEAST FLORIDA--THREE MAPS--HARDNESS OF WATER, CHLORIDE CONCENTRATION, AND POTENTIOMETRIC SURFACE, MAY 1974, Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 7C. W76-05859

GEOHYDROLOGY OF THE EVANGELINE AND JASPER AQUIFERS OF SOUTHWESTERN LOUISIANA,

Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 2F. W76-05861

AVAILABILITY OF GROUND WATER IN THE AVALABILITY OF GROUND WATER IN THE ANDROSCOGGIN RIVER BASIN, NORTHERN NEW HAMPSHIRE, Geological Survey, Concord, N.H. For primary bibliographic entry see Field 7C. W76-05862

COMPILATION OF METHODOLOGY USED FOR MEASURING POLLUTION PARAMETERS OF SANITARY LANDFILL LEACHATE, Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering. For primary bibliographic entry see Field 5A. W76-05869

PUMPING-TEST ANALYSIS USING A DISCRETE TIME-DISCRETE SPACE NUMERICAL METHOD,

Birmingham Univ. (England). Dept. of Civil En-

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B-Groundwater Management

K. R. Rushton, and S. J. Booth. Journal of Hydrology, Vol. 28, No. 1, p 13-27, January 1976. 11 fig, 3 tab, 10 ref.

Descriptors: *Groundwater, *Pumping, *Numerical analysis, *Aquifer characteristics, Wells, Computer models, Drawdown, Aquifer testing, Sand aquifers, Head loss, Resistance networks, Unsteady flow, Computers, Water wells, Works, Chiscady flow, Company Turbulence.
Identifiers: *Step drawdown tests, Well loss, Radial flow model, Dewatering losses.

The application of a digital computer model of radial flow in an aquifer to the estimation of aquifer parameters was considered. Pumping-test data for a shallow unconfined gravel aquifer, in which the drawdown recorded at the pumped well is a significant proportion of the thickness of the aquifer, were used to test the method. The model was sufficiently flexible to allow for decrease in the saturated thickness, vertical components of flow, well losses and variations of aquifer parameters in time and space. (Prickett-ISWS) W76-05913

GROUNDWATER STUDY OF A VOLCANIC AREA NEAR BANDUNG, JAVA, INDONESIA. Cowiconsult Ltd., Copenhagen (Denmark). B. Pulawski, and H. Obro. Journal of Hydrology, Vol. 28, No. 1, p 53-72, January 1976. 13 fig, 3 tab, 13 ref.

Descriptors: *Groundwater resources, *Areal *Groundwater availability, hydrogeology, *Hydrologic budget, Water resources develop-ment, Aquifer management, Groundwater basins, *Water supply, Geohydrologic units, Transmissivity, Hydraulic conductivity, Springs, Water quality, Wells, *Feasibility study. Identifiers: *Indonesia, *Java, Volcanic terrain,

Resistivity survey.

A hydrogeological investigation of the Bandung area, Java, Indonesia, was described. The investigation was carried out as part of a feasibility study directed towards improvement and development of the city's water supply. The area is situated in a tropic mountainous region, dominated by pyroclastic volcanic deposits and with abundant rainfall. The main activities of the investigation were compilation and evaluation of existing climatological and hydrogeological data, testing of four existing wells, a geo-electrical survey, drilling and testing of a new test well, study of water quality by analysis of samples from both springs and wells, and measurements of spring yields. A sum-mary of these data was given in the conclusions. The results of the investigation indicated presence of large groundwater resources within a distance of 15-20 km from the city. The feasibility study recommended that Bandung's water supply be based on these groundwater resources, and this recommendation is being implemented. (Prickett-W76-05914

GEOLOGY AND WATER RESOURCES OF CHARLES MIX AND DOUGLAS COUNTIES, SOUTH DAKOTA, PART I: GEOLOGY, Geological Survey, Vermillion, S. D. For primary bibliographic entry see Field 4A. W76-05923

EXPLOITATION OF THE WATERS OF SUB-PERMAFROST ARTESIAN BASINS, For primary bibliographic entry see Field 3B. W76-05930

PORTABLE WATER SAMPLING APPARATUS, Universal Oil Products Co., Des Plaines, Ill. For primary bibliographic entry see Field 7B. W76-05958

EFFECT OF DEPTH AND SALINITY OF GROUND WATER ON EVAPORATION AND SOIL SALINIZATION, Central Soil Salinity Research Inst., Karnal

(India) For primary hibliographic entry see Field 2D

NORTHERN GREAT PLAINS RESOURCE PRO-GRAM

Northern Great Plains Resources Program, Denver, Colo For primary bibliographic entry see Field 6D.

4C. Effects On Water Of Man's Non-Water Activities

W76-06036

EFFECTS OF FOREST FERTILIZATION ON TWO SOUTHEAST ALASKA STREAMS, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5C. W76-05612

IMPACT OF CLEAR-CUTTING AND ROAD CONSTRUCTION ON SOIL EROSION BY LANDSLIDES IN THE WESTERN CASCADE RANGE, OREGON,

Oregon Univ., Eugene. Dept. of Geology. F. J. Swanson, and C. T. Dyrness. Geology, Vol 3, No 7, p 393-396, 1975. 1 fig. 1 tab,

Descriptors: *Road construction, *Clear-cutting, *Slope stability, *Soil erosion, Forest management, *Oregon.

The H. J. Andrews Experimental Forest can be divided into two zones of approximately equal area, each with strikingly different susceptibilities to erosion by rapid soil movements. A stable zone occurs at elevations above 900 to 1,000 m in terrain underlain by lava-flow bed rock. Since logging and road cutting began in 1950, only two small road-related slides have taken place in the stable zone. In contrast, the unstable zone, located at elevations below 1,000 m and underlain by altered vol-caniclastic rock, has been the site of 139 slides during the same period. Slide erosion from clearcut areas in the unstable zone has totaled 6,030 m3/km2, or 2.8 times the level of activity in forested areas of the unstable zone. Along road rights-of-way, slide erosion has been 30 times greater than on forested sites in the unstable zone; however, only about 8 percent of a typical area of deforested land in the unstable zone is in road right-of-way. At comparable levels of development (8 percent roads, 92 percent clear-cut), road right-of-way and clear-cut areas contribute about equally to the total impact of management activity on erosion by landslides in the unstable zone. The combined management impacts in the unstable zone (assuming 8 percent road right-of-way and 92 percent clear-cut) appear to have increased slide activity on road and clear-cut sites by about 5 times relative to forested areas over a period of about 20 years. (Forest Service) W76-05614

PINE MANAGEMENT INFLUENCES THE SOUTHERN WATER RESOURCE, Forest Service (USDA). Southern Forest Experiment Station. For primary bibliographic entry see Field 5B. W76-05616

THE IMPACT OF TIMBER HARVEST, FERTILIZATION, AND HERBICIDE TREATMENT

ON STREAMWATER QUALITY IN WESTERN OREGON AND WASHINGTON, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B.

LIMNOLOGICAL DATA FOR THE MAJOR STREAMS IN CHESTER COUNTY, PENNSYL-

Geological Survey, Harrisburg, Pa. For primary bibliographic entry see Field 7C. W76-05852

SEDIMENT CHARACTERISTICS OF FIVE STREAMS NEAR HARRISBURG, PENNSYL-VANIA, BEFORE HIGHWAY CONSTRUCTION, Geological Survey, Harrisburg, Pa. I. A Reed

Available from Supt. of Documents, GPO, Wash., D.C. 20402, Price \$0.65. Water-Supply Paper 1798-M. 1976, 29 p. 24 fig. 1 tab. 6 ref.

Descriptors: *Sediment transport, *Road construction, *Farm ponds, *Small watersheds, *Pennsylvania, Sedimentation, Rainfall-runoff relationships, Streamflow, Turbidity, Erosion control, Basic data collections, Planning. Identifiers: *Enola(Pa).

Rainfall streamflow sediment and turbidity data are presented as part of a study to evaluate the effects of highway construction on sediment discharge and for determining the effectiveness of different erosion-control measures in reducing sediment discharges. The study area, near Enola, Pa., consists of five adjacent drainage basins, four of which will be crossed by Interstate 81. Ninety percent of the land in each of the basins is in forest or grass. Active farmland accounts for less than 10 cent, and the remainder is in roadways and buildings. The major factor affecting sediment concentrations and discharges was the construction of a one-lane roadway and a 5-acre farm pond. Approximately 100 tons of sediment was discharged by the stream as a result of the roadway and pond construction. (Woodard-USGS) W76-05854

HYDROLOGIC ASPECTS OF URBANIZATION. V. V. Kupriyanov.

V. V. Kupriyanov. Soviet Hydrology, Selected Papers, No. 5, p 405-412, 1973. 4 fig, 3 tab, 14 ref. Translated from Transactions of the State Hydrologic Institute (Trudy Gossudarstvennogo Gidrologicheskogo In-stituta), No. 2-6, p 122-133, 1973.

Descriptors: *Urbanization, *Hydrologic aspects, Pescriptors. "Oranization, "Flydrologic aspects," "Urban runoff, Land use, Human population, Ci-ties, Urban hydrology, Urban drainage, Runoff, Weather, Discharge(Water), Low flow, Sedi-ments, Water quality, Hydrology.

The changes introduced by human activity are most clearly reflected in the runoff and water quality of urbanized areas. The effect of cities on the bodies of water of the surrounding areas is determined, first of all, by the ratio of the area occupied by a city to the drainage area. If the areas occupied by large modern cities of 100 sq km or more are considered, it is natural that their effect on the qualitative and quantitative regime of bodies of water and groundwater will spread to relatively large drainage basins. This refers parrelatively large trainage ossins. Ins reters par-ticularly to water quality. Study of the hydrology of cities, where most of the population and materi-al assets are concentrated, becomes particularly important because drastic changes in the land-scape are introduced there that disturb the natural relations between the elements of the hydrologic budget. These changes may lead to catastrophic consequences with improper construction water-management organization. (Simspoor ISWS) W76-05925

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Watershed Protection-Group 4D

EFFECT OF URBANIZATION ON THE QUALI-TY OF RIVER WATER,
For primary bibliographic entry see Field 5B.
W76-05926

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SLOPE RUNOFF AND ITS CHANGE UNDER THE EFFECT OF AGRICULTURAL AND FOREST IMPROVEMENT PRACTICES, V. Ye. Vodogretskiy, E. A. Zaytseva, and L. V.

Soviet Hydrology, Selected Papers, No. 5, p 421-444, 1973. 7 fig. 16 tab, 15 ref. Translated from Trudy Gossudarstvennogo Gidrologicheskogo In-stituta, No. 206, p 172-207, 1973.

Descriptors: *Runoff, *Slopes, *Forests, *Agricultural watersheds, Forest watersheds, Watersheds(Basins), Farm management, Forest management, Soils, Rainfall-runoff relationships, Vegetation establishment, Vegetation effects, Agricultural runoff, Forestry, Hydrology. Identifiers: *USSR.

The method developed for estimating the effect of agricultural practices on slope runoff, based on an analysis of the relation between the runoff coefficient and the moisture reserves in the soil, its freezability, and slope steepness, refined the exist-ing recommendations. The method made it possible to roughly estimate the effect of agricultural practices with allowance for differences in soils and slope steepness for two zones of the European USSR and the steppe regions of Northern Kazakh-stan. Failure to allow fully for the soils and slopes of fields can lead to substantial errors and mainly to an overestimation of the change in slope runoff by a factor of 1.5-2. (Sims-ISWS) W76-05927

SNOW ACCUMULATION AND MELTING IN THE FOREST AND IN CLEAR-CUT AREAS IN THE CENTRAL URAL,

Vsesoyuznyi Nauchno-Issledovatelskii Institut Lesovodstva i Mekhanizatsii Lesnogo Khozyaistva, Pushkino (USSR).

For primary bibliographic entry see Field 2C. W76-05929

SOIL PROCESSES AND INTRODUCED CHEMI-

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. D. G. Moore, and L. A. Norris.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. In: Environmental Effects of Forest Residues Management in the Pacific Northwest. State of Knowledge Compendium. USDA Forest Service Technical Report, PNW-24, p. C-1 to C-33. 1974. 1 fig, 5 tab, 69 ref.

Descriptors: Fertilizers, Pesticides, Cycling nutrients, Soil formation, *Soil chemical proper-ties, Forest management, Clear-cutting, Lumber-ing, Burning, *Soil treatment. Identifiers: Fire retardants.

Forest residue management is not likely to have a short-term influence on soil formation unless significant surface erosion or soil mass movements occur. Long-term changes in the rate and direction of soil formation may result from intensified management practices including residue treatmanagement practices including resulte treament. Clearculting and severe burning temporarily interrupt or reduce nutrient cycling, but normal cycling is restored as revegetation occurs. All types of burning result in loss of some nitrogen. Availability of other nutrients is increased temporarily after burning, and some recovery of nitrogen may occur through increased nitrogen fixation. Mechanical treatment and spreading of residues increase the rate of both residue decomposition and nutrient release, but availability of native nitrogen may become limiting and the addi-tion of fertilizer nitrogen necessary. Fertilizer and fire retardant chemicals increase the nutrient content of residues and may influence the selection of residue treatment methods. (Forest Service)

SOIL STABILITY AND WATER YIELD AND OUALITY.

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D. W76-05937

EFFECTS OF FOREST FERTILIZATION WITH UREA ON STREAM WATER QUALITY-QUIL-CENE RANGER DISTRICT, WASHINGTON, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05938

DEMAND FOR DISSOLVED OXYGEN EX-ERTED BY FINELY DIVIDED LOGGING DEBRIS IN STREAMS,

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. S. L. Ponce, and G. Brown.

Forest Research Laboratory, School of Forestry, Oregon State University, Res. Pap. 19, October, 1974. 10 p, 4 fig, 3 tab, 4 ref.

Descriptors: *Wood wastes, *Toxicity, *Organic matter, *Biochemical oxygen demand, Water sam-pling, Forest management, Water pollution sources, Fish toxins, *Dissolved oxygen, Leaves. Identifiers: Needles.

The impact of Douglas fir needles and twigs, western hemlock needles, and red alder leaves on dissolved oxygen and thus on the quality of mountain stream water was examined. The mean COD, 90-day BOD, and BOD rate coefficients were, respectively, 454 mg 02/g, 110 mg 02/g, and 0.125 for Douglas fir needles, 947 mg 02/g, 110 mg 02/g, and 0.056 for Douglas fir twigs, 570 mg 02/g, 110 mg 02/g, and 0.056 for Douglas fir twigs, 570 mg 02/g, 200 mg 02/g, and 0.049 for western hemlock needles, and 882 mg 02/g, 286 mg 02/g, and 0.047 for red alder leaves. The 90-day values of BOD and K1 could be estimated accurately by tests of 20, 20, and 60 days, respectively, for Douglas fir needles, western hemlock needles, and red alder leaves. Fluctuating temperature exerted a 5-day BOD 4.0, 2.4, and 4.2 times greater than the standard temperature BOD5 for Douglas fir needles, western hemlock needles, and red alder leaves, respectively. Toxicity of a leachate extracted from each spely. Toxicity of a leachate extracted from each species was determined on guppies and steelhead trout fry. The concentration of material needed to produce toxic effects was very high, so high, in fact, that oxygen depletion probably would be responsible for death long before the leachate effect. Data on oxygen depletion obtaind in this study will be useful in developing a predictive model for water quality management on forested lands (Forest Service) lands. (Forest Service) W76-05939

IMPACT OF FOREST FERTILIZATION ON WATER QUALITY IN THE DOUGLAS-FIR REGION -- A SUMMARY OF MONITORING STU-DIES.

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05943

SLOPE STABILITY PROBLEMS ASSOCIATED WITH TIMBER HARVESTING IN MOUNTAINOUS REGIONS OF THE WESTERN UNITED STATES, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. D. N. Swanston

General Technical Report PNW-21, 1974. 14 p. 9

Descriptors: *Soil stability, *Soil erosion, Debris avalanches, Creep, Landslides, Mass wasting, Forest management, Mountain forests, *Lumbering.

Identifiers: Western U.S., Soil mass movement.

Natural soil-mass-movements on forested slopes in the Western United States can be divided into two major groups of closely related landslide types. These include, in order of decreasing im-portance and regional frequency of occurrence (1) debris slides, debris avalanches, debris flows, and debris torrents; and (2) creep, slumps, and earth flows. Each type requires the presence of steep slopes, frequently in excess of the angle of soil stability. All characteristically occur under high soil moisture conditions and usually develop or are ac-celerated during periods of abnormally high rainfall. Further, all are encouraged or accelerated by destruction of the natural mechanical support on the slopes. (Forest Service) W76-05944

HARVESTING SOUTHERN FORESTS: A THREAT TO WATER QUALITY, Forest Service (USDA), Oxford, Miss. Southern

Forest Experiment Station.

For primary bibliographic entry see Field 5B. W76-05945

ROAD STANDARDS ON STEEP TERRAIN IN THE PACIFIC NORTHWEST U.S.A. WITH SUG-GESTIONS FOR IMPLEMENTATION,

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. D. N. Swanston.

In: New Requirements in Forest Road Construction (FP2406). Proceedings of symposium sponsored by Association of B.C. Professional Foresters and University of British Columbia, Dec. 9-11, 1974. Vancouver, B.C. p. 137-146.

Descriptors: *Road design, *Design standards, *Road construction, Maintenance, *Oregon, Standards, Pacific Northwest U.S., Erosion control.

A summary of road design, construction and main-tenance standards used by the U.S. Forest Service and the State of Oregon in implementation of their Forestry Practices Act is presented with suggestions for effective implementation. (Forest Ser-W76-05948

DICAMBA RESIDUES IN STREAMS AFTER FOREST SPRAYING, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05949

THE FOREST ECOSYSTEM OF SOUTHEAST ALASKA 5. SOIL MASS MOVEMENT, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D. W76-05950

4D. Watershed Protection

IMPACT OF CLEAR-CUTTING AND ROAD CONSTRUCTION ON SOIL EROSION BY LANDSLIDES IN THE WESTERN CASCADE RANGE, OREGON,

Oregon Univ., Eugene. Dept. of Geology. For primary bibliographic entry see Field 4C.

RESERVOIR SEDIMENTATION ASSOCIATED WITH CATCHMENT ATTRIBUTES, LAND-

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4D-Watershed Protection

SLIDE POTENTIAL, GEOLOGIC FAULTS, AND SOIL CHARACTERISTICS, Forest Service (USDA), Berkeley, Calif., Pacific

Southwest Forest and Range Experiment Station. H. W. Anderson.

In: Proc. Third Federal Inter-agency Sedimenta-tion Conference, Denver, Colorado March 22-25, 1976. Symposium 1.--Sediment Yield and Sources. Water Resources Council p 35-46, 1976.

Descriptors: *Erosion, *Deposition, *Bedload, *Sedimentation, Landslides, Geologic faults, Soil physical characteristics, Snow, Geology, Streamflow, Forest fires, Roads, Highways, Reservoirs, Watershed management, Geomorphology, Eleva-tion, Slope, Forests, Brushlands, Flood frequen-

Identifiers: *Rural roads, *Mountain roads, *Grazing, *Trap efficiency(Reservous), Watershed shape, Channel slope, Climatic stress,

Deposition measurements in 48 northern California reservoirs were found related to precipitation amount, rain-snow frequency, road standards and location, forest fires, geology, and physiography, and also to differences among watersheds (catchments) in landslide classes, extent of geologic faults, clay content of watershed soils, and density of reservoir sedimentation. The data were analysed by reduced rank principal component techniques. The final regression equation had an explained variance of 0.86 and a standard error of 0.138 log units. Difference in average annual deposition associated with reservoir density was percent; with landslides, 100 percent; with faults, 41 percent; and with clay in watershed soils, 32 percent. Some geologic rock types with geologic faults and high landslide potential had a predicted sediment rate as much as 17 times that of areas without faults. Roads located near streams contributed the most to deposition--twice as much as did roads located elsewhere. And improved secondary roads near streams were the single greatest contributor, especially in areas of steep terrain. Roads in steep topography produce twice as much acceleration in sedimentation as do those in less steep terrain. Preliminary appraisal of bedload (difference between reservoir deposition and suspended sediment discharge) indicate it varies from 90 percent to less than 20 percent of 'total load' in different areas. (Forest Service) W76-05617

THE IMPACT OF TIMBER HARVEST, FER-THE IMPACT OF TIMBER HARVEST, FER-TILIZATION, AND HERBICIDE TREATMENT ON STREAMWATER QUALITY IN WESTERN OREGON AND WASHINGTON, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05618

NUTRIENT CYCLING IN 37- AND 450-YEAR-OLD DOUGLAS-FIR ECOSYSTEMS. Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05619

THE HYDROLOGIC POTENTIAL OF UNIT AREAS: A BASIS FOR MANAGING WATER RESOURCES, Forest Service (USDA), Berkeley, Calif., Pacific

Southwest Forest and Range Experiment Station. H. W. Anderson.

In: Proceedings Second World Congress on Water Resources, International Water Resources As-sociation, New Delhi, India, December 1975, Volume IV, p 61-69, 1975. 18 ref.

Descriptors: *Streamflow, *Natural flow, flow, *Average flow, *Evapotranspiration. *Flood

*Precipitation(Atmospheric), Snowfall, Rainfall-

runoff relations, *Watershed management, Vegetation effects, Forest fires, Geology, Topography, Analytical techniques, Regression analysis, Methodology, *California.

In deciding how to manage an area for water, the water resources manager needs to know what the land produces, or could be made to produce, in water, floods, or sediment yield. This hydrologic potential of forest sites can be interpreted from analysis of watershed models that express site characteristics as variables. Six streamflow parameters expressing annual and 10-year frequency characteristics were related to 21 to 29 watershed variables. The data for analysis were drawn from 109 watersheds in northern California, covering the period 1881 to 1971. These stream-flow records were adjusted to the 81-year record by using one of 10 key stations. The 29 variable, 109 catchment, data matrix was tested for inde-pendence by factor analysis. To reduce the correlation between some variables, 16 watersheds were dropped from analysis. Then the quantitative relations were determined by regression using reduced rank principal component analysis. Ex-plained variance ranged from 72 to 87 percent for the annual and flood streamflow parameters, but only 46 to 48 percent for the two low-flow parame ters. The quantitative results are given by the 185 regression coefficients obtained. Wide differences in management problems and potentials were indicated. For example, for the nine geologic types tested, annual streamflow potentials were as little as 30 percent of average to more than three times average. Low flows were even more variable, with the granitic rocks yielding low flows only 1 to 3 percent as high as the basic and ultra basic rock types (Basalt and Serpentine). Such differences imply different problems of management for water supply. (Forest Service)
W76-05620

GUIDELINES FOR CHARACTERIZING NATU-RALLY UNSTABLE OR POTENTIALLY UNSTABLE SLOPES ON WESTERN NATIONAL

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. D. N. Swanston

D. N. Swanston.

In: New Requirements in Forest Road Construction (FP2406). Proceedings of symposium sponsored by Association of B.C. Professional
Foresters and University of British Columbia,
Dec. 9-11, 1974. Vancouver, B.C. p 122-136.

Descriptors: *Slope stability, *Soil erosion, Mass wasting, Environmental effects, Soil physical pro-perties, *Forest management, Watershed manage-ment, Climates, *Geomorphology, *Lithification, *Vegetation, Hydrology, Bedrock. Identifiers: *Bedrock lithology

A technique is presented for developing a qualitative characterization for developing hazard rating of unstable slopes on western forest lands. Six environmental qualities are identified which should be given careful consideration in judging stability of natural slopes in terms of surface erosion and soil mass movement. They are: landform features; soil characteristics; bedrock lithology and structure; vegetative cover; hydrologic characteristics of site; and climate. These are described, and the slope stability factors which each encompasses are discussed. (Forest Service) W76-05621

HANLON CREEK ECOLOGICAL STUDY, PHASE B.
Guelph Univ. (Ontario). Centre for Resources

For primary bibliographic entry see Field 6G.

FALLOUT CS-137: A TOOL IN CONSERVA-TION RESEARCH, Agricultural Research Service, Oxford, Miss.

For primary bibliographic entry see Field 2J. W76-05690

SEDIMENT CHARACTERISTICS OF FIVE STREAMS NEAR HARRISBURG, PENNSYL-VANIA, BEFORE HIGHWAY CONSTRUCTION, Geological Survey, Harrisburg, Pa. For primary bibliographic entry see Field 4C. W76-05854

IMPACTS OF HYDROLOGIC MODIFICATION ON WATER QUALITY,
MITRE Corp., McLean, Va.
For primary bibliographic entry see Field 5G.

W76-05866

MIAMI RIVER WATERSHED PROJECT: IN-TRODUCTION,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05886

PLUTONIUM CONCENTRATIONS IN WATER AND SUSPENDED SEDIMENT FROM THE MIAMI RIVER WATERSHED, OHIO.

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05887

PLUTONIUM IN AQUATIC BIOTA OF THE GREAT MIAMI RIVER WATERSHED, OHIO, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5C. W76-05888

DEPENDABLE VIELD OF RESERVOIRS WITH INTERMITTENT INFLOWS.

Agricultural Research Service, Stillwater, Okla. Water Conservation Structures Lab For primary bibliographic entry see Field 4A. W76-05908

FACTORS INFLUENCING INFILTRATION AND SEDIMENT PRODUCTION OF SEMIARID RANGELANDS IN NEVADA,

Texas A and M Univ., College Station. Dept. of Range Science. For primary bibliographic entry see Field 2G. W76-05912

SLOPE RUNOFF AND ITS CHANGE UNDER THE EFFECT OF AGRICULTURAL AND FOREST IMPROVEMENT PRACTICES, For primary bibliographic entry see Field 4C. W76-05927

SOIL STABILITY AND WATER YIELD AND QUALITY, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. J. Rothacher, and W. Lopushinsky.
For sale by the Superintendent of Documents,

U.S. Government Printing Office, Washington, D.C. 20402. In: Environmental Effects of Forest Residues Management in the Pacific Northwest. State of Knowledge Compendium. USDA Forest Service Technical Report, PNW-24, p D-1 to D-23. 1974. 1 fig, 2 tab, 52 ref.

Descriptors: Soil erosion, *Soil management, *Soil stability, Soil compaction, *Water quality, *Water yield, Watershed management, Forest management, Soil treatment, *Burning, Lumbering, Douglas fir trees.

Forest residue activities influence soil and water resources in proportion to the amount they in-crease soil disturbance. Drastic disturbance of litter and surface soil can lead to surface erosion and stream sedimentation. Residues and residue and stream sedimentation. Residues and residue treatment would not normally increase mass soil erosion nor would water yields change significantly. The quantity of chemicals in streams increases when rate of decomposition of residues exceeds uptake by vegetation. Burning of forest residues increases the quantity of chemicals that may reach streams roughly in proportion to the quantity of fuel burned. Broadcast burning after logging of old-growth Douglas-fir increased loss of nutrient cations 1.6 to 3.0 times that from an unburned area. (Forest Service)

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EFFECTS OF FOREST FERTILIZATION WITH UREA ON STREAM WATER QUALITY--QUIL-CENE RANGER DISTRICT, WASHINGTON, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B.

GEOLOGY AND GEOMORPHOLOGY OF THE H. J. ANDREWS EXPERIMENTAL FOREST, WESTERN CASCADES, OREGON, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. F. J. Swanson, and M. E. James. Research Paper PNW-188, 14 p. 1975. 5 fig, 11 ref.

Descriptors: Demonstration watersheds, Geology, "Soil management, "Geomorphology, "Forest Management, Mass transfer, "Watershed manage-ment, "Oregon, "Mass wasting. Identifiers: Soil mass movement, "Western

Cascades(Ore).

At low and middle elevations in the H. J. Andrews Experimental Forest, the bedrock geology is com-prised of Little Butte Formation altered volcaniclastic rocks, predominantly of ash flow and mudflow origin. This unit is overlain by upper Miocene and Pliocene lava flows which contain some interbeds of pyroclastic and fluvial material. The present landscape has been formed during approximately the past 4 million years by fluvial, glacial, and mass movement processes. Both shallow and deep-seated mass movements tend to occur in the relatively unstable rocks of the Little Butte Formation and especially in the contact zone where lava flows cap unstable volcaniclastic rocks. The close link between bedrock geology and mass movements should be useful in forest management decisions concerned with lands in the Western Cascades. (Forest Service) W76-05941

TIMBER PRODUCTION AND WATER QUALITY - PROGRESS IN PLANNING FOR THE BULL RUN, PORTLAND, OREGON'S MUNICIPAL WATERSHED, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05942

IMPACT OF FOREST FERTILIZATION ON WATER QUALITY IN THE DOUGLAS-FIR REGION -- A SUMMARY OF MONITORING STU-DIES.

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B.

SLOPE STABILITY PROBLEMS ASSOCIATED WITH TIMBER HARVESTING IN MOUN-

TAINOUS REGIONS OF THE WESTERN 5. WATER QUALITY UNITED STATES,

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4C. W76-05944

INTERPRETING STABILITY PROBLEMS FOR

THE LAND MANAGER,
Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station.

In: New Requirements in Forest Road Construction (FP2406). Proceedings of symposium spon-sored by Association of B.C. Professional Foresters and University of British Columbia, Dec. 9-11, 1974. Vancouver, B.C. p. 147-176.

Descriptors: *Slope stability, *Erosion, Mass wasting, Debris avalanches, Soil mechanics, Forest management, Land management, *Canada. Identifiers: Soil creep, Slumps, Earthflows, Debris flows, Soil mass movement, British Colum-

Major soil mass movement problems faced by the forest land manager are discussed, with particular emphasis on problems on forest lands in British Columbia, Canada. A basic model describing the mechanics of soil mass movements is presented and the controlling and contributing factors to slope stability under natural and manipulated conditions are discussed. (Forest Service) W76-05947

ROAD STANDARDS ON STEEP TERRAIN IN THE PACIFIC NORTHWEST U.S.A. WITH SUG-GESTIONS FOR IMPLEMENTATION,

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4C. W76-05948

THE FOREST ECOSYSTEM OF SOUTHEAST ALASKA 5. SOIL MASS MOVEMENT, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. D. N. Swanston.

General Technical Report PNW-17, 1974, 22 p. 8 fig. 27 ref.

Descriptors: *Erosion control, *Debris avalanches, *Mass wasting, Slope stability, Excess water(Soils), Forest management, Bedrock, Conservation, *Alaska, Lumbering.

Identifiers: Timber harvesting, *Soil mass move-

Research in southeast Alaska has identified soil mass movement as the dominant erosion process, with debris avalanches and debris flows the most frequent events on characteristically steep, forested slopes. Periodically high soil water levels and steep slopes are controlling factors. Bedrock structure and the rooting characteristics of trees and other vegetation exert a strong influence on relative stability of individual sites. Timber harvesting operations have a major impact on initiation and acceleration of these movements. The cutting of timber itself has been directly linked with accelerated mass movements, and the accumulation of debris in gullies and canyons has been identified as a major contributor to the formation of large-scale debris flows or debris torrents. The limited road construction on steeper slopes thus far has had a relatively small impact. Effective management practices on such terrain consist of identification and avoidance of the most unstable areas and careful control of forest harvesting operations in questionable zones. (Forest Service) W76-05950

MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

QUALITY AND VARIATION OF POLLUTANT LOADS IN URBAN STORMWATER RUNOFF, Windsor Univ. (Ontario). Dept. of Civil Engineer-

For primary bibliographic entry see Field 5B. W76-05576

AUTOMATED DILUTION FOR MEASURE-MENT OF NITRATE IN WATER,

Canada Centre for Inland Waters, Burlington (Ontario).

P. D. Goulden, and Y. P. Kakar.

Analytical Letters, Vol. 8, No. 10, p 763-768, 1975. 1 fig. 2 tab. 3 ref.

Descriptors: *Analytical techniques, *Waste water(Pollution), *Nitrates, Measurement, Pumps, Sewage effluents, Water analysis, *Pollutant identification, *Automation. Identifiers: *AutoAnalyzer.

Multiple dilutions on an AutoAnalyzer up to a 1200:1 ratio were performed to analyze nitrate levels in water over the range 2 micrograms/liter to 250 mg/liter nitrogen. The manifold used contained two pumps, one for the first two dilutions and one for the actual nitrate determination. The effects of dilution ratios in a single dilution step were determined and repeated twice to test for reproducibili-ty of the sampling process. A major source of loss of integrity was found to be the debubbling and resampling process. A variety of natural water samples and sewage effluents were analyzed for nitrate by addition at the approximate manifold addition point. The precision of the analysis was determined by analyzing natural water samples and determining the coefficients of variation. It was found that the coefficients of variation over the dilution ranges were not significantly different. The dilution technique is applicable to other analyses besides nitrate in the AutoAnalyzer. (Loustau-FIRL)

STREAM ANALYZERS ARE FOR WASTE AS WELL AS PRODUCT,

A. Klein.

Control Engineering, Vol. 22, No. 12, p 39-41, December, 1975. 5 fig.

Descriptors: *Instrumentation, *Analytical techniques, *Waste water treatment, *Pollutant identification, Automation, Computers, Design,

Identifiers: Analyzers, On-line technology.

The latest design and application trends in on-line analytical instruments are described. Two gas analyzers, both instruments designed to be tied in analyzers, both instruments designed to be ted in with control loops and computing elements to cor-rect or trim a process, are the type OJ oxygen analyzer and the type UJ particulate monitor, designed by Bailey Meter. Beckman offers an air quality chromatograph that works better than in-frared or flame ionization methods. Houston Atlas' hydrogen sulfide gas analyzer utilizes the specific reaction between lead acetate and H2S to form dark lead sulfide which is detected by a CdS photocell and differentiated to provide a dc signal. A Honeywell digital computer and a teletypewriter are teamed up with the old chromatograph system. Continuous on-line analytical service is also of-fered by L & M in process photometry, dif-ferential refractometry, and trace oxygen analysis. The Taylor Instrument Servomex OA-269 industri-al flue gas oxygen analyzer can be used on flue or stack gases with a high concentration of condensa-

Group 5A-Identification Of Pollutants

ble vapors at ambient temperatures. Among liquid analyzers is Delta's total carbon analyzer. It has a nephelometric detector that uses visible light and conventional optics to eliminate the need for filtered microliter sampling such as other detector might require. Hach's automatic chlorine analyzer uses as a chlorine reagent an orthotolidine solution that is twice as strong as typical solutions. Milton Roy Company offers pH, conductivity, sodium ion, dissolved oxygen, and colorimetric analyzers. A closed loop fuel oil viscosity control system is the newest product of Newton, Massachusetts. (Loustau-FIRL)

TRACE ELEMENT, MINERALOGY, AND SIZE DISTRIBUTION OF SUSPENDED MATERIAL SAMPLES FROM SELECTED RIVERS IN EASTERN KANSAS,

Kansas Univ., Lawrence. Dept. of Geology. For primary bibliographic entry see Field 5B. W76-05606

EFFECTS OF FOREST FERTILIZATION ON TWO SOUTHEAST ALASKA STREAMS, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5C. W76-05612

COMPARATIVE EFFECTIVENESS OF THE STANDARD SURBER SAMPLER AND A HYDRAULIC MODIFICATION FOR ESTIMATING BOTTOM FAUNA POPULATIONS, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 7B. W76-05613

ESTIMATING DRY WEIGHT OF LIVE, UNANESTHETIZED FISH BY PHOTOGRAPHY, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. C. L. Hawkes.

C. L. Hawkes.

Journal of the Fisheries Research Board of Canada, Vol. 32, No. 2, p. 321-324, 1975. 3 fig, 4 ref.

Descriptors: *Photography, Measurement, Fish management, Weight, Toxicity, *Estimating, Fish, Water pollution, *Salmon, *Pollutant identification.
Identifiers: Chronic oral toxicity.

A photographic technique for indirectly estimating the dry weight of live fish is described with an example for fingerling coho salmon (Oncordynchus kisutch). This technique does not utilize anesthetizing, blotting, or other harsh treatments associated with weighing live fish. It was developed for studies on which size, weight, etc., must frequently be obtained with a minimum of damage to fish. The example given is the development of the regression equation correlating actual dry weights with photographically measured indices of lateral area. The equation obtained has a coefficient of determination (r2) of 0.954. (Forest Service)

NUTRIENT CYCLING IN 37- AND 450-YEAR-OLD DOUGLAS-FIR ECOSYSTEMS, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B. W76-05619

THE APPLICATION OF SEQUENTIAL ESTI-MATION METHODS TO COUNTS OF PHYTOPLANKTON,

Comitato Nazionale per l'Energie Nucleare, Rome (Italy). Technological Lab. F. Moller, and A. Zattera. Available from the National Technical Information Service, Springfield, Va. 22161, as RT BIO 747 \$4.00 in paper copy, \$2.25 in microfiche. Report RT/BIO(74)7, February 1974. 75 p, 13 fig, 23 tab, 11 ref.

Descriptors: *Estimating, *Estimating equations, *Phytoplankton, Population, Distribution, Analytical techniques, Average, Computer programs, Sampling.

Identifiers: Sequential estimation, LABEN 70.

Randomly distributed algae may be counted by dividing the sediment surface into parallel fields and enumerating cells in each field. In the fixed counting plan, pre-established square fields are counted and cell numbers extrapolated to the whole surface and sediment volume. In the sequential counting plan, random fields are counted. A population is characterized by its mean and variance. Knowledge of variance permits determination of population homogeniety and confidence in the mean estimation. Component dispersions about the expected mean depend on covariance between counts of individuals of each species. Total dispersion is the sum of dispersions of single components if the correlation coefficient between single and total counts is unity. The parallel field experiment is easier to handle and program. The sequential method applied to parallel fields is described. A program in BASIC language was written for the LABEN 70 computer. Use of the sequential method seemed justified because of the time needed for counting and statistical characterization of results. Application depends on population concentrations on the sediment surface. The method can be used to count algae in cultures and natural phytoplankton populations and applied in relation to the sediment volume related with the higher or lower count. (Buchanan-Davidson--Wisconsin). W76-05622

AN ICHTHYOFAUNAL SURVEY AND DISCUSSION OF FISH SPECIES DIVERSITY AS AN INDICATOR OF WATER QUALITY, CODORUS CREEK DRAINAGE, YORK COUNTY, PENNSYLVANIA,

York Coll., Pa.

R. F. Denoncourt, and J. W. Stambaugh. Proceedings Pennsylvania Academy of Science, Vol. 48, p. 71-78, 1974. 4 fig., 3 tab., 24 ref.

Descriptors: *Fish, *Varieties, *Surveys, *Baseline studies, Pennsylvania, Water pollution effects, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Water quality, Tributaries, Bioindicators.

Identifiers: *Codorus Creek(Pa.), York County(Pa.), Species diversity indices.

Fish distribution and physical parameters were studied during 1970-1973 in Codorus Creek, Pennsylvania. A total of 6806 fish representing 6 families, 23 genera, and 41 species of hybrid com-binations were collected. Fish in the Main and West Branches included many typical of warm waters and minnows tolerant of moderate to heavy pollution. The East and South Branches contained many minnows with low tolerance to organic pollution, a few typical of warm water, and no goldfish or carp. Temperature rose in some downstream sites and dissolved oxygen decreased due to sewage effluents. Hydrogen ion concentration was usually 7.3-7.7 and showed no consistent or significant variation. The mean number of species followed the increase in species number with increasing stream order. The mean and range of species diversity indices showed the same deviations as total species number and mean number of species. Use of fish species diversity indices for water quality assessment not recommended. Decreasing oxygen may have caused decreased fish diversity below Spring Grove and York. Dissolved oxygen, species number, and species diversity followed the same trends. Lists of fish species taken in Codorus Creek and its tributaries (East

Branch, South Branch and Tyler Run), and species diversity indices, are given. (Buchanan-Davidson-Wisconsin)

ASSESSMENT OF A STRESSED MACROIN-VERTEBRATE COMMUNITY, Virginia Polytechnic Inst. and State Univ.,

Blacksburg. Dept. of Biology. For primary bibliographic entry see Field 5C. W76-05636

RAPID DETERMINATION OF THE COD OF EFFLUENTS (USKORENNOE OPREDELENIE KHPK STOCHNYKH VOD),
Tsentral'nii Nauchno-Issledovatel'skii i Proektnii

Tsentral'nii Nauchno-Issledovatel'skii i Proektnii Institut Lesokhimicheskoi Promyshlennosti, Khimki (USSR). G. A. Ishcherikova, N. P. Drozdov, N. V.

G. A. Ishcherikova, N. P. Drozdov, N. V. Galyanova, and L. N. Smirnova.
Gidroliznaya i Lesokhimicheskaya Promyshlennost, No. 7, p 25, 1975. 1 ref.

Descriptors: *Pollutant identification, *Water analysis, *Chemical oxygen demand, *Effluents, Volumetric analysis, Biochemical oxygen demand, Water properties, Water quality, Analytical techniques, Testing procedures, Water pollution sources, Chemical wastes. Identifiers: Syava silvichemical factory(USSR).

This method for COD determination uses only simple equipment and is suitable for routine plant control determinations. A 10 ml sample (diluted if necessary) is placed in an Erlenmeyer flask, 10 ml of a 0.2 normal solution of potassium dichromate and 30 ml concentrated sulfuric acid containing the catalyst are added, and the mixture is heated on an electric plate for 10 minutes. Following dilution with water to 100 ml, titration is conducted with a 0.05 normal solution of Mohr's salt in the presence of o-phenanthroline indicator. The COD values obtained are equal to 88.5% of values obtained by the standard method. A correction factor is used to express the COD in values corresponding to those obtained by the standard method. It was established that to 5-day BOD of the Syava silvichemical factory effluent is 62% of its COD. Thus, the 5-day BOD can be calculated directly from COD. (Stapinski-IPC) W76-05705

ANALYSIS OF PULP AND PAPER MILL WASTE WATERS BY HIGH-RESOLUTION ION-EXCHANGE CHROMATOGRAPHY, Oregon Univ., Portland.

A. W. Lis, R. K. McLaughlin, J. Trau, G. D. Daves, Jr, and W. R. Anderson, Jr. Tappi, Vol. 59, No. 1, p 127-129, Jan., 1976. 3 fig, 13 ref.

Descriptors: *Pulp wastes, *Water analysis, *Pollutant identification, Wastes, Industrial wastes, Water pollution sources, Aeration, Ion exchange, Chromatography, Water pollution, Effluents, Biochemical oxygen demand, Organic compounds, Aerated lagoons.

Identifiers: Magnefite pulping, Magnesium-base

Identifiers: Magnefite pulping, Magnesium-base sulfite pulping, Sulfite pulp mills, Refiner ground-wood pulp, Ultraviolet spectroscopy, Mechanical pulp mills.

A high-resolution anion-exchange analyzer was used to detect ultraviolet-absorbing components of waste waters from a pulp and paper mill using both Magnefite (Mg-base sulfite) and refiner mechanical (groundwood-from-chips) pulping processes. Approximately 25 major ultraviolet-absorbing peaks were obtained from the influent of two aerated treatment lagoons, and 113 peaks were found in the effluent of the second lagoon. Effectiveness of the aeration treatment exceeded 90%. Spectrometric examination of a large peak of the influent revealed a complex mixture of hydrocarbon-like materials. This method is com-

pared to a general pollution index (BOD). (Sykes-IPC) W76-05709

RAPID PHOTOCHEMICAL DECOMPOSITION OF ORGANIC MERCURY COMPOUNDS IN

OF ORGANIC MERCUAY COMPOUNDS IN NATURAL WATER, Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands). Forschungslaboratorium. A. M. Kiemeneij, and J. G. Kloosterboer.

Analytical Chemistry, Vol. 48, No. 3, p 575-578, March, 1976. 6 fig, 9 ref, 1 tab.

Descriptors: *Water analysis, *Mercury, *Pollutant identification, Trace elements, Ultraviolet radiation, Analytical techniques, Inorganic compounds, Water pollution sources, Chemicals, Water pollution, Natural streams, Water properties, Water chemistry, Metals, Toxister.

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A method has been developed for the determina-A method has been developed for the determinations of total mercury in water at concentrations in the parts per billion (ppb) range. Decomposition of organo mercurials is carried out by means of ultraviolet radiation of a suitable wavelength from small low-pressure lamps containing either Zn, Cd, Hg, or a mixture of these metals in their cathodes. The formed inorganic mercury is determined in the usual way by cold vapor atomic absorption after reduction of Hg(++) to Hg. Determinations with and without irradiation make possiminations with and without irradiation make possi-ble separate determination of total and inorganic mercury, respectively. Irradiation times are approximately 20 minutes. The photochemical analysis of natural water samples is compared with the wet-chemical analysis. The results agree within 4% at a level of 1 microgram/liter, even for unfiltered samples. The photochemical method, which requires a minimum of reagents, yields substan-tially lower blank values than the wet-chemical method. (Witt-IPC) W76-05715

REMOVAL OF COPPER AND IRON PRIOR TO WATER HARDNESS TITRATION.

Energy Research and Development Administra-J. S. Fritz, and J. N. King. Analytical Chemistry, Vol. 48, No. 3, p 570-572, March, 1976. 10 ref, 2 tab.

Descriptors: *Water analysis, *Hardness(Water), *Copper, *Iron, Separation techniques, Silica, Gels, Calcium, Magnesium, Analytical techniques, Water properties, Water quality, Water pollution sources, *Pollutant identification.

Silica gel was reacted with 3-aminopropyltriethoxysilane or with the N-methyl derivative of the same reagent to produce a material with an amino silyl functional group. When a water sample of pH 5.0-7.5 is passed through a short column of this material, iron (II) and copper (II) are completely retained, while calcium (II) and magnesium(II) pass through. This permits an accurate water hardness titration without adding any cyanide. (Witt-IPC) W76-05716

EXTRACTION VISIBLE SPEC. EXTRACTION - VISIBLE SPECTROPHOTOMETRIC METHOD FOR DETERMINATION OF NITRATE: APPLICATION TO

MINATION OF NITRATE: APPLICATION TO WATER ANALYSIS, Zagreb Univ. (Yugoslavia). M. Siroki, Z. Stefanac, and L. J. Maric. Microchemical Journal, Vol. 20, No. 4, p 483-491, Dec., 1975. 5 fig, 8 ref, 2 tab.

Descriptors: *Water analysis, *Nitrates, Spectrophotometry, Colorimetry, Analytical techniques, Chemical analysis, Water pollution sources, "Pollutant identification, Separation techniques, Color, Potable water, Color reactions, Trace elements, Water chemistry, Water properties, Water quality.

A colorimetric method for the determination of nitrate is described. The method is based on the extraction of nitrate with tetraphenylphosphonium extraction of nitrate with tetraphenylphosphonium chloride followed by the exchange of nitrate in the extract with intensely colored vanadium-4-(2-pyridylazo)resorcinol complex and spectrophotometric measurement of the latter. The color intensity of the extract is stable and reproducible. The application of the method to water analysis was investigated, and a procedure for the determination of nitrate in drinking water is developed. (Witt-IPC) W76-05717

WATER POLLUTION IN CONNECTION WITH BARK DUMPING (VATTENFORORENINGAR I SAMBAND MED BARKDEPONERING).

Swedish Cellulose Co., Sundsvall. For primary bibliographic entry see Field 5B. W76-05726

A COULOMETRIC DEVICE FOR MEASURING

TOTAL OXYGEN DEMAND,
Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands).

American Laboratory, Vol. 8, no. 1, p 41-43, January, 1976. 2 fig, 3 illus.

Descriptors: *Water analysis, *Oxygen demand, Analytical techniques, Water properties, Instru-ments, Trace elements, Water quality. Identifiers: *Coulometry.

The total oxygen demand of a water sample is determined by measuring the amount of oxygen consumed when the oxidizable matter in the sample is burned in a gas containing oxygen. The sample is injected into a stream of gas of known ox-ygen content, and the decrease in oxygen concentration is measured coulometrically after com-bustion. The meter display of the instrument gives a direct reading of absolute total oxygen demand in mg oxygen/liter. The meter has linearity in all ranges and a wide measuring range (zero to 10,000 mg oxygen/liter total oxygen demand). No calibration curve is necessary and no reagents are required. (Witt-IPC) W76-05728

CHEMICAL CHARACTERIZATION OF FIBER BUILDING BOARD MILL EFFLUENT, Swedish Forest Products Research Lab...

Stockholm.

U. M. B. Jansson, and E. L. Back. Wood Science, Vol. 8, No. 2, p 112-121, Oct., 1975. 2 fig, 33 ref, 7 tab.

Descriptors: *Water pollution sources, *Pulp wastes, *Pollutant identification, Waste water(Pollution), Water properties, Wastes, Industrial wastes, Carbohydrates, Lignins, Trace elements, Water quality, Orgnic compounds.

Identifiers: *Building board, White water, Asplund pulp, Glucomannan, Xylan, Klason lignin, Hardboards, Hemicelluloses.

Two pine hardboard white waters, warm water extracts of spruce and mixed hardwood Asplund pulps, and the pulps themselves were analyzed. About one-half of the solids in white waters and extracts was of carbohydrate origin, 15-20% was lignin-related, and 2-5% was inorganic. Glucomannan was dissolved to a greater extent than was the xylan. Most of the acetyl groups remained in the pulps. Ultrafiltration of the white waters and spruce extract indicated that the xylan and arabinan components had a lower molecular weight than the glucomannan components, and that the Klason lignin in the white waters had a higher molecular weight than that of the extracts. (Buchanan-IPC) W76-05731

AN AUTOMATED TECHNIQUE FOR THE SUB-MICROGRAM DETERMINATION OF SELENI-UM AND ARSENIC IN SURFACE WATERS BY ATOMIC ABSORPTION SPECTROSCOPY, Utah State Div. of Health, Salt Lake City, Bureau of Laboratories.

F. D. Pierce, T. C. Lamoreaux, H. R. Brown, and R S. Fraser.

Applied Spectroscopy, Vol. 30, No. 1, p 38-42, January/February, 1976. 5 fig, 6 ref, 3 tab.

Descriptors: *Arsenic compounds, *Water analysis, *Spectroscopy, Analytical techniques, *Pollutant identification, Water pollution sources, Spectrophotometry, Natural streams, Trace elements, Automation.
Identifiers: *Selenium, Hydrogen selenide,

A description is given of a fully automated method for the analysis of Se and As in surface waters by atomic absorption spectroscopy. The technique employs sodium borohydride for conversion of Se and As compounds in speciments to hydrogen selenide and arsine. To increase the efficiency of hydride recovery for analysis, the reacted specimen is stripped using a heated column. The hydride gas and hydrogen evolved from the chemical reaction is then combusted in a tube furnace placed in the optical path of an atomic absorption spectrophotometer. Seventy specimens can be analyzed/hr with a detection limit of 0.019 micrograms/liter for Se and 0.011 micrograms/liter for As. (Witt-IPC) W76-05736

EFFECTIVE USE OF HIGH WATER TABLE AREAS FOR SANITARY LANDFILL. VOL. II, VTN, Inc., Orlando, Fla.

For primary bibliographic entry see Field 5G.

IMPACT OF COAL STRIP MINING ON WATER QUALITY AND HYDROLOGY OF EAST TEN-NESSEE,

Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.

W76-05833

NATURE AND STABILITY OF COMPLEX MERCURY COMPOUNDS IN SURFACE AND GROUND WATERS, PHASE II,

Auburn Univ., Ala. Dept. of Chemistry. J. E. Land, W. R. Mountcastle, H. T. Peters, and C. Sinkule.

Available from the National Technical Inform Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 375, \$4.50 in paper copy, \$2.25 in microfiche. Alabama Water Resources Research Institute, Auburn, Bulletin 24, January 1976. 54 p, 10 fig, 4 tab, 23 ref. OWRT A-038-ALA(1).

Descriptors: *Phosphates, Chelation, *Hydrolysis, *Mercury, Metals, Aqueous solutions, Mathematical models, Equilibrium, Ions, *Pollutant identification, Analytical techniques. Identifiers: *Methylmercury, Stability constants, Ionic equilibria, Ligands, Complexing, Ionic special Participations. cies, Polymeric complexions.

Attempts to determine the hydrolytic and polymeric species present at 25C in an aqueous solution of methylmercury hydroxide, with an ionic strength of 0.10M using potassium nitrate, as a function of the hydronium ion concentration by present of electromylium force pressurements and means of electromotive force measurements and polarographic analysis are described. Three mathematical models are presented which might account for the possible equilibria involved and ar-guments based upon collected data are advanced to show that one of these is more likely than the other two. To ascertain if slow attainment of equilibrium between the methylmercury species was causing the electromotive force and reduction

Group 5A-Identification Of Pollutants

potentials to be meaningless, studies were made at a higher temperature of 35C, but the results were neglection of stability constants for methylmercury - ligand systems proved to be impossible since the hydrolytic equilibria are undetermined. (See also W74-02441) W76-05838

SELECTED WATER-QUALITY DATA FROM FALLEN LEAF LAKE, EL DORADO COUNTY, CALIFORNIA, JUNE THROUGH OCTOBER 1974

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 7C. W76-05848

LIMNOLOGICAL DATA FOR THE MAJOR STREAMS IN CHESTER COUNTY, PENNSYLVANIA.

Geological Survey, Harrisburg, Pa. For primary bibliographic entry see Field 7C. W76-05852

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS COAL REGION OF EASTERN MONTANA, 1975-76, Geological Survey, Helena, Mont. For primary bibliographic entry see Field 7C.

W76-05853

TABLE OF DATA ON WATER QUALITY OF BAKER LAKE NEAR MOUNT BAKER, WASHINGTON,

Geological Survey, Tacoma, Wash. For primary bibliographic entry see Field 7C. W76-05857

HYDROGEOCHEMICAL DATA FROM IN-VESTIGATION OF WATER QUALITY IN SEWERED AND UNSEWERED AREAS, SOUTHERN NASSAU COUNTY, LONG ISLAND, NEW YORK, Geological Survey, Mineola, N.Y.

Geological Survey, Mineola, N.Y. For primary bibliographic entry see Field 7C. W76-05858

FLORIDAN AQUIFER IN NORTHEAST FLORIDA--THREE MAPS--HARDNESS OF WATER, CHLORIDE CONCENTRATION, AND POTENTIOMETRIC SURFACE, MAY 1974, Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 7C. W76-03859

GEOHYDROLOGY OF THE EVANGELINE AND JASPER AQUIFERS OF SOUTHWESTERN LOUISIANA.

Geological Survey, Baton Rouge, La. For primary bibliographic entry see Field 2F. W76-05861

AVAILABILITY OF GROUND WATER IN THE ANDROSCOGGIN RIVER BASIN, NORTHERN NEW HAMPSHIRE,

Geological Survey, Concord, N.H.
For primary bibliographic entry see Field 7C.
W76-05862

AN ASSESSMENT OF AUTOMATIC SEWER FLOW SAMPLERS - 1975,

EG and G Washington Analytical Services Center, Inc., Rockville, Md. For primary bibliographic entry see Field 5D. W76.08864 COMPILATION OF METHODOLOGY USED FOR MEASURING POLLUTION PARAMETERS OF SANITARY LANDFILL LEACHATE,

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

E. S. K. Chian, and F. B. DeWalle. Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 102, \$7.50 in paper copy, \$2.25 in microfiche. Environmental Protection Agency. Report EPA-600/3-75-011, October 1975. 163 p., 38 fig, 1 tab, 32 ref, 2 append. EPA 1DB064; ROAP 21BFQ; Task 002 C1 68-03-2052.

Descriptors: Chemical analysis, *Landfills, Biochemical oxygen demand, *Leachate, Waste disposal, *Leaching, *Pollutant identification, Colorimetric analysis, Solid wastes, Chemical analysis, Lysimeters, Analytical techniques, Methodology.

Identifiers: Leachate analysis.

Different analytical methods can be used to determine a specific parameter; a preliminary laboratory evaluation was made of those methods least subject to interferences. All analyses were conducted with a relatively concentrated leachate sample obtained from a lysimeter filled with milled solid waste. The results indicate that strong interferences are sometimes encountered when using colorimetric tests due principally to the color and suspended solids present in leachate. In such instances alternative methods were evaluated or recommendations were made to reduce the interfering effects. Automated chemical analysis using colorimetric methods can sometimes experience significant interferences. (EPA)

NUCLEAR TECHNIQUES IN HYDROLOGY-CURRENT STATUS AND PROSPECTIVE USES. National Academy of Sciences, Washington, D.C.; National Committee for the International Hydrological Decade, Washington, D.C.

Hydrological Decade, Washington, D.C. Final Report of the Work Group on Nuclear Techniques in Hydrology of the U.S. National Committee for the International Hydrological Decade, National Academy of Sciences, Washington, D.C., 1975. 43 p. 3 append.

Descriptors: "Hydrology, "Isotope studies, "International Hydrological Decade, Radioisotopes, Stable isotopes, Deuterium, Tritium, Tracers, Neutron absorption, Gamma rays, Snow, Ice, Surface waters, Groundwater, Water pollution, Pollutants, Radioactivity techniques, Pollutant identification, Path of pollutants. Identifiers: "Nuclear techniques the pollutants and pollutants."

Nuclear techniques in hydrology are those which use stable or radioactive isotopes, either natural or man-made or radioactive emissions, to provide partial or complete answers to specific questions concerning the flux of water and material dissolved or suspended in it, fluid transport and deposition, the framework of aquifers and watersheds, and the physical, chemical, and biological processes occurring within the hydrological cycle. The application of these techniques to hydrological studies falls short of the potential inherent in even the existing technology. Further, the basic science shows promise of being applicable to many new study areas. The two principal reasons for the limited use of nuclear techniques in hydrology are: (1) the existence in many instances of established non-nuclear techniques, and (2) the shortage of hydrologists familiar with nuclear techniques and their possibilities. A summary outline of the application of nuclear techniques in hydrology was presented in an appendix. (Sims-ISWS)

MIREX RESIDUES IN SELECTED ESTUARIES
OF SOUTH CAROLINA: JUNE 1972,
Environmental Protection Agency, Gulf Breeze

Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.

P. W. Borthwick, G. H. Cook, and J. M. Patrick, Jr. Pestic Monit J. 7(3/4): 144-145. Illus.1974.

Descriptors: *Pesticide residues, *South Carolina, *Estuaries, Fish, Sediments, Crabs, Shrimp, Insect control, *Pollutant identification, Monitoring, Sunfishes, Catfishes, Crap, Bottom sampling. Identifiers: *Mirex, Fire ants, Blue crabs.

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Estuarine sediments, crabs, shrimps and fishes were collected in June 1972 at 11 stations 2 yr after aerial applications of mirex bait for control of fire ants in coastal areas near Charleston, South Carolina. These stations had previously been monitored (Oct. 1969-June 1971) when levels of mirex in animal samples were: crabs, 0-0.60 ppm; shrimps, 0-1.3 ppm; and fishes, 0-0.82 ppm. The recent study showed that mirex was present in 3 species of fishes (white catfish, 0.021 ppm; bluegill, 0.047 ppm; carp, 0.12 ppm) and blue crabs (0.026 ppm) at freshwater stations. However, mirex was not detected in 36 animal samples, most of which were taken from 9 saline stations in the estuaries after a period of restricted use of the pesticide. Analysis of bottom sediment samples at all stations detected no mirex. The lower limit of detection of mirex was 0.01 ppm.—Copyright 1974, Biological Abstracts, Inc.

PORTABLE WATER SAMPLING APPARATUS, Universal Oil Products Co., Des Plaines, Ill. (Assignee). For primary bibliographic entry see Field 7B. W76-05958

APPARATUS FOR COLLECTING SURFACE PARTICLE ON BODY OF WATER,
For primary bibliographic entry see Field 5G.

INSTRUMENTAL METHOD FOR THE DETER-MINATION OF TRACE ELEMENTS IN WATER SAMPLES BY NEUTRON ACTIVATION ANAL-

Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Laboratorio Radioattivita Ambientale. G. F. Clemente, and G. G. Mastinu.

G. F. Clemente, and G. G. Mastinu. J Radioanal Chem. 20(2): 707-714. 1974.

Descriptors: *Neutron activation analysis, *Spectrometer, Analytical techniques, Computers, Gamma rays, Trace elements, Water analysis, Identifiers: Italy.

Thermal neutron activation analysis and a large-volume high-resolution Ge(Li) y-ray spectrometer, connected on-line to a computer, were used to measure the concentrations of Na, Sc, Cr, Fe, Co, Ni, Zn, As, Se, Br, Rb, Ag, Sb, Cs, W and Hg in some Italian subsurface water samples. The instrumental method requires neither a chemical separation technique nor a pre- or post-concentration of the trace elements to be detected. This method eliminates many inherent errors associated with chemical determinations. The technique is sensitive, precise and particularly suitable for routine analysis of many trace elements at both natural and pollution levels in water samples. The interferences due to fast neuron (n, p) and (n, a) reactions are not appreciable, with the only exception of the 54 Fe(n, p) 54Mn and 58 Ni(n, p) 58Co reactions. Losses of volatile elements, e.g. As, Br and Hg, during irradiation was negligible.—Copyright 1975, Biological Abstracts, Inc. W76-05998

THE RELIABILITY OF MERCURY ANALYSIS IN ENVIRONMENTAL MATERIALS, International Atomic Energy Agency, Vienna (Austria)

(Austria). J. Heinonen, and O. Suschny.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Identification Of Pollutants-Group 5A

J Radioanal Chem. Vol 20 No 2 p 499-519. 1974.

Descriptors: *Mercury, *Analysis, Analytical

Identifiers: Activation analysis, Atomic absorption analysis.

Nine intercomparisons of the determination of Hg present as impurity in different materials (including food) were organized. Laboratories (24) in 10 different countries took part, mainly using activation analysis and atomic absorption techniques. The reliability of the data produced and reported in this area leaves much to be desired, and continuous control of the quality of Hg analysis in the extremely low concentration range is essential .-- Copyright 1975, Biological Abstracts, Inc. W76-06007

CHEMICAL CHARACTERIZATION OF INDUS-TRIAL WASTEWATERS BY GAS CHRO-MATOGRAPHY-MASS SPECTROMETRY, Environmental Research Lab., Athens, Ga. L. H. Keith.

Sci Total Environ 3(1): 87-102 1974

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Descriptors: *Pollutant identification, Chemical wastes, *Gas chromatography, *Mass spectroscopy, Legislation, *Organic wastes, Louisiana, Rivers, *Industrial wastes. Identifiers: Calcasieu River(La).

Organic pollutants in 7 industrial wastewaters being discharged into the Calcasieu River in Louisiana (USA) were identified by gas chromatography and mass spectrometry. Discharge of compounds not indicated from the manufacturer's lists of products and raw materials were revealed. Chemical characterization provided information pertinent for pollution legislation enforcement.--Copyright 1975, Biological Abstracts, Inc.

CAUSE AND IDENTIFICATION OF TASTE AND ODOUR COMPOUNDS IN WATER, Rijksinstituut voor Drinkwatervoorziening. The Hague (Netherlands).

B. Cees, J. Zoeteman, and G. J. Piet. Sci Total Environ. 3(1): 103-115. 1974.

Descriptors: *Pollutant identification. *Odor. *Taste, Algae, Water pollution sources, Organic wastes, Organic compounds, Potable water, compounds, Potable water, Microorganisms, Effluents

Identifiers: Chlorinated compounds. *Netherlands

Odor compounds in water may originate from industrial and municipal sewage effluents or from biological activities of algae and heterotrophic microorganisms. The relative importance of these 2 sources of odor substances is discussed for The Netherlands. A number of organic compounds that are responsible for odor problems in effluent water, river water and drinking water are presented. Different chlorinated compounds cause offensive water odors. Some recommendations for maximum allowable concentrations of odor compounds in effluents, surface waters and drinking water are given .-- Copyright 1975, Biological Abstracts. Inc. W76-06009

LIMNOLOGICAL CHARACTER OF EXPERI-MENTAL RESERVOIRS TREATED WITH TRITOX 30% (DDT. DMDT. GAMMA HCH). National Inst. of Hygiene, Warsaw (Poland). Dept. of Communal Hygiene.

For primary bibliographic entry see Field 5C. W76-06012

GULF OF ST. LAWRENCE, Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
J. M. Bewers, I. D. MaCaulay, and B. Sundby.

Can J Earth Sci. 11(7): 939-950. 1974

Descriptors: Metals, Trace elements, Gulfs, Cadmium, Cobalt, Copper, Iron, Lead, Nickel, Zinc. Identifiers: *Gulf of St Lawrence.

Concentrations of the trace elements, Fe, Co, Ni, Cu. Zn. Cd. and Pb were measured in samples collected from the waters of the Gulf St. Lawrence. Cobalt, cadmium, and lead occurred at or below the detection limits of the analytical method. The mean concentrations of Ni, Cu and Zn were 0.4 microgram/l, 0.6 microgram/l and 1.8 microgram/l, respectively, and there was no evidence that local conditions influence their distribution. The distribution of dissolved and colloidal Fe is related to dilution and precipitation processes which occur as fresh and saline waters are mixed. The particulate iron distribution is largely governed by water circulation patterns and settling.--Copyright 1975, Biological Abstracts, Inc. W76-06024

SOME HELMINTHS OF BULINUS TRUNCATUS AND BIOMPHALARIA ALEXANDRINA FROM THE IRRIGATION SYSTEM NEAR CAIRO,

Ceskoslovenska Akademie Ved, Pragu Parazitologicky Ustav. B. Rysavy, F. Moravec, V. Barus, and F. Yousif. Folia Parasitol (Prague). 21(2): 97-105. 1974.

Descriptors: *Snails, Africa, Irrigation systems. Identifiers: *Biomphalaria-Alexandrina, *Bulinus-Cairo, Echinopharyphium-Recurvatum, Echinostoma-Revolutum, *Egypt, Enoplidae, *Helminths, Paramphistomatidae, Rhabditis-Sp, Strigeidae, Xiphidiocercaria.

The helminth fauna of snail intermediate hosts of schistosomes pathogenic to man were studied. The snails were collected in the area of Warak El Arab (north of Cairo, Egypt). The snail B. alexandrina was infected with cercariae of the trematode Echinostoma revolutum and with Rhabditis sp., apparently a pseudoparasitic nematode species.

The snail B, truncatus was infected with cercariae of Echinoparyphium recurvatum, 1 cercarial species each of the families Strigeidae and Paramphistomatidae, with a xiphidiocercaria, and with nematodes of the family Enoplidae. Both snail species harbored metacercariae of E. revolutum and E. recurvatum, those of a strigeid species, and 2 other metacercarial species (xiphidio-metacercariae). Descriptions and drawings are given for all helminth species found except for those described and figured in other papers. The echinostome translodes E. revolutum and E. recurvatum were chosen for experimental study on larval competition with human schistosomes in shared snail hosts.--Copyright 1975, Biological Abstracts, Inc. W76-06028

A NOTE ON THE USE OF ALGAL SIZES IN ESTIMATES OF POPULATION STANDING CROPS, Victoria Univ. of Manchester (England). Pollution

Research Unit.

E. G. Bellinger. Br Phycol J. 9(2): 157-161, 1974.

Descriptors: *Standing crops, *Algae, Estimating, *Phytoplankton, *Systematics, Biomass.

Counts of cell numbers of phytoplankton algae of differing sizes do not accurately reflect the biomass of the population present. For a better estimate it is suggested that cell numbers be multiplied by the average cell volume for each species present. Data on cell volumes for certain species are given and compared with results from other authors. Surface areas and surface area to volume

TRACE METALS IN THE WATERS OF THE ratios are also given and the importance of these parameters noted .-- Copyright 1974, Biological Abstracts. Inc. W76-06043

> ION EXCHANGE TECHNIQUE FOR THE DETERMINATION OF CHLORINATED DETERMINATION PHENOLS AND PHENOXY ACIDS IN OR-GANIC TISSUE, SOIL, AND WATER, National Swedish Environment Protection Board,

Stockholm, Wallenberg-Lab. L. Renberg.

Anal Chem. 46(3), p 459-461, 1974.

Descriptors: *Ion exchange, *Pollutant identification, *Phenols, *Organic acids, Organic com-pounds, Soils, Eels, Fish, Analytical techniques. Identifiers: *Chlorinated phenols.

Diazomethane is used as methylation agent in the method described. In the case of the phenoxy acetic acids, a new derivatization procedure is developed. Besides the methyl esters, the 2chloroethyl esters are also prepared. The method was tested on fish found dead in a river in the south of Sweden where a discharge of the fungicide pentachlorophenol was suspected. A water sample, taken 2 days later also was analyzed. The levels of pentachlorophenol were in accordance with those found to be lethal for the eel.--Copy-right 1975, Biological Abstracts, Inc. W76-06122

DETERMINATION OF SELENIUM IN NATU-RAL WATERS USING THE CENTRIFUGAL PHOTOMETRIC ANALYZER,

Tennessee Univ., Knoxville. Dept. of Chemistry. For primary bibliographic entry see Field 2K.

MERCURY IN SEDIMENTS OF THE HORWER BUCHT (LAKE LUCERNE) AND TRIBUTARY STREAMS SWITZERLAND.

Hobart and William Smith Coll., Geneva, N. Y. Dept. of Chemistry.

T. R. Blackburn.

Schweiz Z Hydrol. 35(2), p 201-205, 1973.

Descriptors: *Mercury, *Lake sediments, Europe, Lakes, Bays, *Pollutant identification, Distribution patterns.

Identifiers: *Atomic absorption analysis, *Lake Lucerne(Switzerland).

The Hg content of sieved, dried sediments from 24 sampling sites in the Horwer Bucht (Lake Lucerne) and its principal tributary stream system in Horw LU (Switzerland) was determined by flameless atomic absorption analysis. Mercury content significantly above background levels was found at several points. The distribution of Hg in the bay sediments implies that the Steinibach (principal tributary of the Horwer Bucht) is the principal supplier of Hg to the bay .-- Copyright 1974, Biological Abstracts. Inc. W76-06136

MERCURY OCCURRENCE IN SEDIMENT CORES FROM WESTERN LAKE ERIE,

Bowling Green State Univ., Bowling Green, Ohio. Dept. of Geology. For primary bibliographic entry see Field 5B.

W76-06137

EVALUATION OF SURFACE WATER POLLU-TION AT SEVERAL POINTS IN RELATION TO ZONES OF SHELLFISH INDUSTRY IN ROAD-STEADS OF THE BREST REGION, (IN FRENCH).

For primary bibliographic entry see Field 5B. W76-06150

Group 5B-Sources Of Pollution

5B. Sources Of Pollution

OUNDWATER QUALITY WELL INJECTION OF OPTIMAL GROUNDWATER MANAGEMENT: WASTE WATERS,

Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.

Water Resources Research, Vol. 12, No 1, p 47-53, February 1976. 2 fig. 3 tab. 24 ref. append.

*Management, *Groundwater. Descriptors: Water quality control, *Waste water disposal, Inwaste quality control, waste water unsposal, in-jection wells, Optimization, Conjunctive use, Pumping, Recharge, Constraints, Design, Planning, Biochemical oxygen demand, Equa-tions, Mathematical models, Systems analysis, Aquifer.

Identifiers: Cost minimization, Mixed integer programming.

Groundwater aquifers are assuming an important role as potential sites for the disposal of waste waters. A mathematical planning model for optimal conjunctive utilization of the groundwater quality and quantity resources of unconfined aquifers is presented. The saturated zone of the groundwater system is considered to be a component of a regional waste treatment system in-volving a waste water treatment plant and external sources of dilution. It is assumed that a waste load is discharged to the system by well injection at a number of predetermined injection sites. The pumping and recharge rates are supposed not to vary with time. Water quality constraints are mainvary with time. Water quanty constraints are main-tained at each pumping well to protect the water supply resources and at the recharge wells to prevent fouling of the wells by organic matter and to preserve the hydraulic capacity of the aquifer. The model minimizes the cost associated with sur face waste treatment while maintaining acceptable water quality levels throughout the aquifer. Results indicate the feasibility of secondary treatment (trickling filter) plus dilution water along with the assimilation capacity of the aquifer for waste water degredation. (Bell-Cornell) W76-05507

RECENT TRENDS IN WATER QUALITY MANAGEMENT AND PROTECTION IN HUN-

National Water Authority, Budapest (Hungary). Water Pollution Control. For primary bibliographic entry see Field 5G. W76-05518

PROCESS FOR BIOCHEMICAL REACTIONS. Gary Aircraft Corp. San Antonio, Tex. (Assignee). For primary bibliographic entry see Field 5D

EXAMINATION AND REMOVAL OF IRON IN GROUNDWATER, Sunnittelukeskus-MKR, Helsinki (Finland).

T. Hatva, Niemisto, and H. Seppanen. Aqua Fennica p. 82-94, 1973, 13 fig., 2 tab., 17 ref.

Descriptors: *Iron, Groundwater, *Iron bacteria, *Oxidation-reduction, Potential, Oxidation, Wells, Hydrogen ion concentration, Pseudomonas, Chlamydomonas, Chelation. Identifiers: *Vyredox method, Pseudomonadales,

Chlamydobacteriales, Eh-measurement Hemoglobine, Pertumaa, Finland, Gallionella

The Vyredox-method of iron removal from groundwater is based on the idea of oxidizing and precipitating iron in the ground. This is done by pumping oxygen saturated, iron-free water into building oxygen saturated, fron-free water into the ground. As a result of the oxidation, the redox equilibrium of the groundwater area rapidly changes to oxidizing conditions, while iron and manganese are precipitated. The change in equilibrium can be extended to a desired area and depth with oxidation wells and an adjustment of the oxidation rate. The principle of the Vyredox method involves the formation of a steady gradient in the groundwater. This gradient is often sharp and is recognized by a brown, ferric iron containing zone in the soil. It can be easily recog-nized in the field and has a significance in determining the most advantageous place and level for groundwater. It is an excellent medium for the growth of gradient organisms such as iron and manganese bacteria. (Ukayli-NWWA)

SUBSURFACE DISPOSAL OF LIQUID INDUS-TRIAL WASTES, Department of

Environment, Ottawa (Ontario). Inland Waters Directorate.

J. A. Vonhof, and R. O. van Everdingen CIM Transactions, Vol. 76, p. 120-126, 1973, 5 fig, 1 tab, 11 ref.

Descriptors: *Waste disposal wells, *Injection wells, *Waste water disposal, Liquid wastes, *Canada, Industrial wastes, Subsurface investigations, Deep wells, Brines, *Brine disposal, Water pollution sources

Identifiers: *Subsurface disposal, *Deep-well injection, Environmental control.

Since 1949, a total of 49 disposal wells have been installed in Canada to inject liquid wastes from refineries, mining operations and chemical plants into subsurface formations at an ever increasing rate. Well depths range from 600 to 5,500 feet; injection rates range from 0.5 gpm (U.S.) to more than 1,000 gpm. Deep-well injection is becoming increasingly more attractive as a method of disposing of liquid industrial wastes. Natural liquid wastes such as oil field brines are less hazardous to the subsurface environment than foreign liquid wastes such as industrial wastes. Apart from strictly technical considerations of well design, the geological, hydrodynamic conditions at the disposal site have a strong bearing on the safety and success of such operations. Prevailing hydrogeological conditions in large portions of the country do not allow safe subsurface disposal. (Gass-NWWA) W76-05573

QUALITY AND VARIATION OF POLLUTANT LOADS IN URBAN STORMWATER RUNOFF, Windsor Univ. (Ontario). Dept. of Civil Engineer-

R. L. Droste, and J. P. Hartt. Canadian Journal of Civil Engineering, Vol. 2, No. 4, p 418-429, December, 1975. 2 fig, 10 tab, 25 ref.

Descriptors: *Urban runoff, *Storm runoff, *Water pollution, *Hydrographs, *Pollutant identification, Precipitation(Atmospheric), Waste water treatment, Tertiary treatment, Sampling, Monitoring, *Canada.

Research into the pollutional loadings of urban storm water was carried out on samples of 13 storms throughout a year in the heavily industrialized town of Windsor, Ontario. Stage levels in the sewers were continuously monitored by a water level recording instrument and hydrographs were made. Samples of discharge were taken and analyzed for such qualities as pH, alkalinity, hardness, BOD, presence of suspended solids, chemical content, and determination of grease and oil. Seasonal and annual average concentration values were calculated and recorded in tabular form. It was found that urban stormwater runoff makes a significant contribution to pollution of receiving waters and is not a suitable diluent for sanitary sewage. Runoff delivers a greater pollutant load than effluent from a secondary treatment plant. Significant correlation was found among the following constituents' concentrations: specific con-ductance and calcium hardness and chlorides; calcium hardness and total hardness; sulfates and total hardness; and total alkalinity and total hardness. Spring, the season with the most rainfall, contributed the highest loads of pollutants except for chlorides and coliforms. Larger amounts of precipitation contributed higher loads to receiving waters. The concentration data given here can be used to plan more efficient treatment of stormwater runoff and to compare the economies and efficiencies of tertiary treatment against treatment of urban runoff. (Loustau-FIRL)

LIME-INDUCED REACTIONS IN MUNICIPAL

WASTEWATERS,
Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5D.
W76-05597

INTERACTIONS OF MERCURY WI AQUATIC AND EDAPHIC ENVIRONMENTS, Kansas State Univ., Manhattan, Dept. of Agrono-

D. W. Newton, R. Ellis, Jr., and G. W. Paulsen. Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 069, \$4.50 in paper copy, \$2.25 in microfiche. Kansas Water Resources Research Institute, Manhattan, Contribution Number 136. 64 p, 11 fig, 11 tab, 67 ref. OWRT B-027-KAN(2). 14-31-0001-3591.

Descriptors: *Heavy metals, *Clays, *Adsorption, *Mercury, Soils, Salts, Chlorides, Pollutant identification, Radioisotopes, Bentonite.
Identifiers: *Description, *Salt effects, Mercury loss, Mercury vaporization.

Reactions of Hg with bentonite clay were studied to determine behavior of the metal in aquatic ecosystems. Mercury (II) adsorption by bentonite as a function of pH and complex formation was inwestigated using a radio-isotopic technique. Maximum Hg(II) adsorption in 0.01 M Ca(NO3)2 systems occurred in the pH range 4.5-5.5. Varying the Ca(NO3)2 concentration only slightly influenced adsorption or the pH of maximum adsorption. Chloride ions sharply reduced Hg(II) ad-sorption, especially at low pH's. At pH 6 or lower, increasing CaCl2 concentration from 10-5 to 10-4 M depressed adsorption; higher CaCl2 levels were required to decrease adsorption at pH 7. At a given Cl concentration, maximum Hg(II) adsorption occurred near the pH where HgClOH occurred as a transition complex between HgCl2 and Hg(OH)2. Chloride salts (0.01 M CaCl2, NaCl, and KCl) were more effective desorbers of Hg(II) than was 0.01 M Ca(NO3)2 or various 0.01 N acids. HCl (0.01 N) removed the most adsorbed Hg(II). Loss of mercury (II) from dilute solutions was studied using 203Hg(II) as a tracer. Magnitude and rate of loss depend on Hg(II) concentration, chemical composition of carrier solutions, and container material. Losses were severe only at Hg(II) concentrations of 10-6 M (0.2 ppm) or lower. Of the Hg-containing solutions studied, loss was greatest from 0.01 M CaCl2; Hg (II) was stable at all levels in the concentrated HNO3. Increasing pH from 4 to 8 appeared to reduce Hg loss. Adding KMnO4 also reduced losses. Glass and plastic containers differ in their ability to retain Hg(II) in solution.

STATISTICAL STUDY OF THE DUCKWEED RHIZOSPHERE AS AN ECO-ASSAY TOOL,

Massachusetts Univ., Waltham. Dept. of Environmental Sciences.

R. A. Coler.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 163, \$3.50 in paper copy, \$2.25 in microfiche. Massachusetts Water Resources Research Center, Amherst, Completion Report, September, 1974. 8 p, 2 tab. OWRT A-049-MASS(1).

Descriptors: *Rhizosphere, *Statistical studies, Monitoring, *Bioassay, *Bioindicate Cyanophyta, Water quality, Plant communities.

Identifiers: *Duckweed, Aphids, *Oscillatoria, Rhopalosiphum nymphaeae. *Lemna.

Two potentially restrictive components of the Lemna environment were introduced and mea-sured: (1) predation, by Lebistes reticulatus (the guppy) which limits biomass directly by consump tion, and (2) Oscillatoria, a blue-green alga which exerts an impact both directly through competition in the aquatic milieu, and indirectly through disruption of plant metabolism by the liberation of endotoxin. Insights into the interaction of en-dogenous stresses were afforded by the sustained observation of a duckweed culture infected with aphids (Rhopalosiphum nymphaeae). The investigations illustrate that in predator-prey relationships as reflected in diversity, it is not possible to distinguish between exogenous and endogenous stress. The application of resident plant communities to water quality monitoring appears plausible if the communities are first permitted to stabilize. The study has also served as the calibration phase for a more rigorous effort in which other river plants could be studied and their response to stress measured by application of a community diversity index (Shannon-Wiener). W76-05605

TRACE ELEMENT, MINERALOGY, AND SIZE DISTRIBUTION OF SUSPENDED MATERIAL SAMPLES FROM SELECTED RIVERS IN EASTERN KANSAS,

Kansas Univ., Lawrence. Dept. of Geology.

E. E. Angino, and H. Schneider.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 164, \$4.50 in paper copy, \$2.25 in microfiche. OWRT A-059-KAN(1), 14-31-0001-3816, Kansas Water Resources Research Institute, Lawrence, KWRRI Contribution No. 169, September 1975, 58 p, 3 fig, 12 tab, 38 ref, 4 append.

Descriptors: *Trace elements, *Mineralogy, Rivers, *Kansas, *Metals, Suspended solids, Flood stages, *Distribution, *Turbidity, *Turbidity, *Sediments, Zinc, Copper, Nickel, Iron, Cobalt, Manganese, *Path of pollutants, Pollutant identifi-

Identifiers: Suspended material, Size distribution, Tuttle Creek Reservoir(Kan).

The major purpose was to examine the mineralogy and the concentrations and locations of trace metals (Zn, Cu, Ni, Fe, Mn, Co) in suspended material transported by eastern Kansas rivers during flood stage. The mineralogical properties of low and high flood stage samples are similar. Most samples contained illite, interlayered material with montmorillonitic and vermiculitic layers, mixed layer material, koalinite, quartz, and feldspar. Vermiculite is of significance in rivers draining the glaciated areas of Kansas but is not statistically significant elsewhere. The size distribution data are similar for all rivers studied with large percentages of clay-size material being added to Tuttle Creek Reservoir. This is a major contributing factor to the consistent turbidity problem in this reservoir. There are many errors involved in collecting, dividing, and dissolving sediment into aqueous fractions and analyzing these fractions. No relations were noted between size data, mineralogy, and the trace element content of the samples. W76-05606

CONTROL OF NITROGEN TRANSFORMA-TIONS IN SOILS,

J. M. Bremner.

Available from the National Technical Informa-Avanable from the National Technical Information Service, Springfield, Va 22161 as PB-251 381, \$5.00 in paper copy, \$2.25 in microfiche. OWRT A-041-IA(1), 14-31-0001-3515, -3815, -4015, Iowa Water Resources Research Institute, Ames Completion Report ISWRRI-61, June 1974. 95 p, 23 ref, 1 append. Descriptors: *Water pollution sources, *Nitrogen compounds, *Fertilizers, Nitrates, Nitrification, Inhibitors, Nitrogen, Nitrogen fixation, Agriculture, Soils, Ammonia, Ureas Eutrophication, Laboratory tests, Water poliution Identifiers: *Urease inhibitors.

World consumption of fertilizer nitrogen has increased at a phenomenal rate since World War II. This trend will result in increased levels of nitrogen in soils, natural waters, crop residues, and municipal and agricultural wastes. The effectiveness of 24 compounds proposed as inhibitors of nitrification in soils was studied by determining the effects of each compound on the amounts of nitrate and nitrite produced when soils treated with ammonium sulfate were incubated at 30C for 14 days. The work performed indicates that N-Serve, 2-chloro-6-(trichloromethyl)-pyridine, is the most effective of the compounds thus far proposed for inhibition of nitrification in soils. The manufacturers of this compound have performed a variety of tests indicating that there is little, if any, risk of adverse effects associated with the use of N-Serve to retard nitrification in soils and reduce nitrate enrichment of water resources. This con-clusion was supported. An appendix included the results of the research conducted as reported in eight journal articles and one dissertation. (See also W74-10334, W74-06349, and W74-03523) (Sims - ISWS) W76-05608

MANAGEMENT INFLUENCES THE SOUTHERN WATER RESOURCE,

Forest Service (USDA), Southern Forest Experiment Station.

In: Proceedings, Symposium on Management of Young Pines, p. 42-48. 1974. 22 refs. Southeastern Area, State and Private Forestry and Southern and Southeastern Forest Experiment Stations.

Descriptors: *Water yield, *Streamflow, *Water quality, *Sediment yield, *Coastal Plains, *Gulf Coastal Plain, Watershed management, Interception, Loblolly pine trees, Water resources, Groundwater recharge, Overland flow, Forest management, Pine trees, Water quality standards, Mississippi.

Identifiers: Site preparation, Sediment production, Water quality legislation.

Activities required to meet the anticipated demand for southern pine products in the next 25 years may temporarily impair water quality and significantly reduce streamflow and groundwater recharge. However, management practices can probably ameliorate such changes. The information needed to establish realistic water quality standards for southern forests is not available. (Forest Service) W76-05616

THE IMPACT OF TIMBER HARVEST, FER-TILIZATION, AND HERBICIDE TREATMENT ON STREAMWATER QUALITY IN WESTERN OREGON AND WASHINGTON

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. R. L. Fredriksen, D. G. Moore, and L. A. Norris. In: Forest Soils and Forest Land Management, Proceedings of the Fourth North American Forest Soils Conference, August 1973. p. 283-313, 1975. 7 fig, 10 tab, 49 ref. Bernier, B., and Winget, C. H.

*Lumbering, *Water *Nutrients, Descriptors: *Herbicides, *Fertilizers, *Nutrients, Forest management, Soil erosion, Sedimentation, Water sources. Nitrogen. *Oregon. Washington.

Sedimentation of forest streams after timber harvest increases exponentially with increasing angle of slope in three experimental watersheds in

western Oregon. Forest roads that crossed steeply inclined stream channels caused much greater levels of sedimentation than roads on ridge tops. More time was required for soils to stabilize from clearcutting and forest roads in the steeper country. In very steep topography, where soil strength is nearly in balance with the potential for downshiding, the largest sedimentation increases are expected as a result of frequent mass crosion events. Nutrients are lost following clearcutting, but the loss decreases rapidly with revegetation. Maximum NO3-N concentration increases in streams have remained well below toxic levels. Nutrient losses by soil erosion are undoubtedly of greater importance on steeper slopes. Forest fertilization-water quality studies indicate that N concentration in streams does not increase to levels exceeding published standards. Total loss of applied nutrient is small and should not have any measurable impact on eutrophication in downstream impoundments. The drift or direct application of spray materials to surface waters is the principal route of herbicide entry to streams. Overland flow and leaching of herbicide are relatively unimportant factors in forest stream pollu-tion. Carefully controlled herbicide applications are not expected to have a significant impact on forest stream quality. (Forest Service) W76-05618

NUTRIENT CYCLING IN 37- AND 450-YEAR-OLD DOUGLAS-FIR ECOSYSTEMS,

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. C. C. Grier, D. W. Cole, C. T. Dyrness, and R. L. Fredriksen.

In: Integrated Research in the Coniferous Forest Biome, Bull. No. 5, Coniferous Forest Biome, Ecosystem Analytical Studies. US/IBP. p. 21-34. 1974. 5 tab, 28 ref. Waring, R.H., and Edmonds, R.L. (eds.).

Descriptors: Water pollution sources, *Cycling nutrients, Forests, *Model studies, Ecosystems, *Coniferous forests, *Douglas fir trees, Pacific Northwest US, *Biomass, Nitrogen, Phosphorus, Potassium, Calcium, Growth rates, *Pollutant identification, *Path of pollutants.
Identifiers: Coniferous forest ecosystems.

Biomass and nitrogen, phosphorus, potassium, and calcium distribution, and biogeochemical and stand nitrogen, phosphorus, potassium, and calci-um budgets were determined for 37- and 450-yearold Pseudotsuga menziesii (Mirb.) Franco stands in the U.S. Pacific Northwest. Biomass of the 450year-old stand is greater, but annual growth is less than that of the 37-year-old stand. About 50% of the annual growth and over 50% of the nutrient uptake and return in the 450-year-old stand occurs in subordinate vegetation compared with less than 15% in the 37-year-old stand. Chemical differences in soil parent material between the two stands are reflected in both the biogeochemical and stand nutrient cycles. (Forest Service) W76-05619

RELATIONSHIPS BETWEEN AREA CHARACTERISTICS AND NON-POINT SOURCE NUTRIENTS IN STREAMS.

Pacific Northwest Environmental Research Lab.,

Corvallis, Oreg. Available from the National Technical Information Service, Springfield, Va. 22161, as PB-240 619 \$4.50 in paper copy, \$2.25 in microfiche. Working Paper No 25, August 1974. 54 p, 11 fig, 7 tab, 23

*Land use, *Drainage area, Descriptors: Descriptors: "Land use, "Drainage area, "Nutrients, "Streams, Watersheds(Basins), Ru-noff, Eutrophication, Surveys, Agricultural watersheds, Forest watersheds, Nitrogen com-pounds, Phosphorus compounds, Soils, Topography, Climates, Geographical regions, Forecasting, Regression analysis, Hydrogen ion concentra-tion, Livestock, Data collections, Farm wastes,

Group 5B-Sources Of Pollution

Maine, New Hampshire, Vermont, Massachusettes, Connecticut, New York, Michigan, Wisconsin, Minnesota.

Identifiers: *Non-point nutrient sources, National Eutrophication Survey.

Land use and stream nutrient-runoff data from 143 stream drainage areas in north-central and northeastern U.S. related only to non-point sources were studied the first year of the National Eutrophication Survey. Mean annual nutrient concentrations were higher in streams draining agricultural lands than in streams draining forested watersheds. Total nitrogen concentrations and stream loadings varied less than total phosphorus concentrations and loadings. Little correlation was found between nutrient export and overall land use. Soil, topography, and climate analyses and positive correlations between flow and percent forest suggested dilution of nutrient export-land use correlations. Regression analyses of total phosphorus and nitrogen against percent forest drainage areas indicated a significant relationship but better predictability was attained by identifying data points by geographic region and comput-ing separate logarithmic regressions. Scatter dia-grams and regression lines indicate that predicta-bility for nitrogen (as opposed to phosphorus) was due more to forest relationship than geographic re gion. Livestock density affected both nitrogen and phosphorus in stream concentrations. Preliminary nutrient concentration prediction models were constructed for nitrogen and phosphorus but the inclusion of slope, soils, climate, etc., should increase their utility. Soil pH and stream nutrients showed significant correlations; concentrations were generally higher in streams draining soils high in bases rather than acidic soils. (Buchanan-Davidson--Wisconsin) W76-05624

APPLICATION OF FACTORIAL ANALYSIS OF PRINCIPAL COMPONENTS TO THE CONTROL OF POLLUTION OF SURFACE WATERS,

WATERS, Institut National de la Sante et (de) la Recherche Medicale, Paris (France).

H. Veiga-Pires, F. Derriennic, A. Leclerc, G. Martin-Bouyer, and F. Roger. Rev Int Oceanogr Med 39/40, p 11-32, 1975.

Descriptors: Water pollution control, Surface waters, Oysters, Shellfish, E coli, Streptococeus, Bacteria, Breeding, Nitrates. Identifiers: Eactorial analysis

The cases of water pollution in the sites of oyster breeding bring a quick expansion of the data, due to the increase of sampled sites and of the parameters that characterize the water. An overall 258 samples were collected. For each, 3 bacy e were retained, i.e., coliforms, Escherichia coli and Streptococcus faecalis, while the physico-chemical parameters of temperature, pH, salinity, nitrates, organic substances, dissolved O2 and BOD5 (biochemical O2 demand) were measured. Due to the existence of quantitative variables and qualitative variables (nitrates), two statistical methods were used. An attempt was made to synthesize the overall estimate of the 258 samples through the factor analysis of the data into principal components. A split-up analysis was done on each of the 3 bacteria, in order to determine which parameter(s) should be chosen to break down the samples into 2 sub-groups.—Copyright 1975, Biological Abstracts, Inc.

A STOCHASTIC MODEL OF DISPERSION OF SEDIMENT PARTICLES RELEASED FROM A CONTINUOUS SOURCE

CONTINUOUS SOURCE, Montreal Univ. (Quebec). Dept. of Mathematics. For primary bibliographic entry see Field 2J. W76-05663 VERTICAL DISTRIBUTION OF NITRATE CON-CENTRATION IN INTERSTITIAL WATER OF MARINE SEDIMENTS WITH NITRIFICATION AND DENITRIFICATION, Brussels Univ. (Belgium). Industrial Chemistry

Inst.
J-P. Vanderborght, and G. Billen.

Limnology and Oceanography, Vol. 20, No. 6, p 953-961, November 1975. 7 fig, 22 ref.

Descriptors: *Nitrification, *Denitrification, *Nitrates, *Nitrites, *Mathematical models, Diffusion, Sedimentation, Connate water, Sediments, Marine biology, Sediment-water interfaces, *Path of pollutants, Water pollution sources. Identifiers: *Vertical profiles, Nitrogen transfer, Ostend(Belgium).

Vertical concentration profiles of nitrate and nitrite in interstitial water of sediment in the Sluice Dock at Ostend (Releium) commonly show a maximum in nitrate concentration at a few centimeters depth where sediments are sandy and poor in or-ganic matter, while in muddy and organic-rich sediments, nitrate is lower in interstitial water than in the overlying water and decreases rapidly with depth. Direct measurements of the activity of au-totrophic nitrifying bacteria in the sediments showed nitrification in the upper few centimeters of sandy sediments but not in muddy sediments. A mathematical model was proposed to analyze quantitatively these experimental results, taking into account nitrification, denitrification, diffu-sion, and sedimentation. Seasonal variations of nitrate concentration in overlying water are slow enough to justify the use of a stationary (steady state) model. When appropriate values were used for the parameters (rate of nitrification, depth of the sedimentary layer in which nitrification occurs, rate of denitrification, diffusion coefficient), some being experimentally determined, the model predicted concentration profiles in good agree-ment with experimental data. (Lardner-ISWS) W76-05678

MOVEMENT OF TRACERS THROUGH SOIL, Ontario Ministry of the Environment, Toronto.

Applied Science Section.

M. Brandes, H. T. Chan, and W. W. Cheng.
Ontario Ministry of the Environment, Research
Report No. S55, 1975. 34 p, 6 fig. 14 ref, 3 tab.

Descriptors: *Tracers, *Groundwater movement, *Tritium, Radioisotopes, Dyes, Soils, Soil water movement, Sands, Clay loam, Groundwater, *Path of pollutants. Identifiers: Fluorescein.

Tracers are needed to follow the movement of groundwaters, especially those into which contaminants may have been introduced by subsurface discharge of effluents. Results of tracer studies indicate that tritium is an excellent label but requires special care and approval by atomic energy agencies, owing to its radioactivity. Fluorescein is an acceptable dye tracer in sand but not in clay or silt soils. (Brown-IPC)

RAPID PHOTOCHEMICAL DECOMPOSITION OF ORGANIC MERCURY COMPOUNDS IN NATURAL WATER,

Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands). Forschungslaboratorium. For primary bibliographic entry see Field 5A. W76-05715

ENVIRONMENTAL ASPECTS OF THE USE OF STARCHES IN THE PAPER INDUSTRY (HLEDISKA OCHRANY ZIVOTNIHO PROSTREDI PRI POUZIVANI SKROBOVYCH PRODUKTU V PAPIRENSKEM PRUMYSLU),

P. G. Soutjesdijk, and G. Smit. Papir a Celuloza, Vol. 30, No. 11, p 245-248, 255, 1975. 6 fig, 2 tab. Descriptors: *Carbohydrates, *Water pollution sources, *Pulp and paper industry, Water pollution control, Wastes, *Industrial wastes, Suspended solids, Dispersion, Cations, Anions, Hydrogen ion concentration, Economics, Biochemical oxygen demand, Chemical oxygen demand.

Identifiers: *Starch, Starch derivatives, Coated paper, Waste paper, Broke(Paper machine waste), White water(Paper machine), Sizing agents.

Starch-based materials in the paper industry are used for tensile strength improvement, surface sizing, and coating of paper. Because of water pollu-tion, the presence of starch in paper mill effluent is undesirable. Because of its dispersing ability, starch also hinders the separation of suspended solids from the effluent in the primary treatment stage. In order to minimize the escape of starch in the effluent, the retention of starch in the paper web has to be enhanced by cationization or anionization. Cationic starches used in pulp stock for strength improvement contain tertiary or quarternary ammonium groups. Starches with tertiary ammonium groups are not usable at a pH higher than 4.5, while those with quarternary ammonium groups work well up to pH 9. To avoid the increase in white water starch content caused by the return of surface-sized broke, the degraded starches used on the size press should also be cationized or anionized. Phosphoric esters of starches used as a coating component are generally well fixed on fibers and are not solubilized during coating broke repulping. The economical advantages of cationic and anionic starches in comparison with the nonionic native starch are stressed. The BOD and COD values for various starch products used in papermaking are given. (Trubacek-IPC) W76-05720

WATER POLLUTION IN CONNECTION WITH BARK DUMPING (VATTENFORORENINGAR I SAMBAND MED BARKDEPONERING),

Swedish Cellulose Co., Sundsvall. M. Zackrisson.

Vatten, Vol. 30, No. 4, p 390-393, 1974. 1 fig, 5 ref, 2 tab.

Descriptors: *Bark, *Solid wastes, *Waste disposal, *Water pollution, Biochemical oxygen demand, Acids, Salts, Organic acids, Drainage water, Recirculated water, Water pollution sources, Wastes, Industrial wastes, Wood wastes. Identifiers: Acetic acid, Propionic acid, Butyric acid.

A bark dumping operation was studied with respect to the amount of pollution in the drainage water. The 7-day BOD discharge was 200-500 kg/day. Acetic, propionic, and butyric acids and their salts were the main organic components dissolved in the water. The results may have been influenced by the fact that the drainage water was recirculated the year prior to the investigation. (Speckhard-IPC) W76-05726

CHEMICAL CHARACTERIZATION OF FIBER BUILDING BOARD MILL EFFLUENT,
Swedish Forest Products Research Lab.,

Stockholm.
For primary bibliographic entry see Field 5A.
W76-05731

SILVER IN PHOTOPROCESSING EFFLUENTS, Eastman Kodak Co., Rochester, N. Y. For primary bibliographic entry see Field 5D. W76-1673. ai

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TRANSFER OF LINDANE FROM BARK OF IN-SECTICIDE-SPRAYED PINE PULPWOOD INTO EFFLUENT FROM A BARKING DRUM (LINDAANIN HUUHTOUTUMISESTA SUOJARUISKUTETUN MANTYKUITUPUUN

RUMPUKUORIMON KUORESTA

JATEVETEEN), Finnish Forest Research Inst., Helsinki K. Lovttvniemi.

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Paperi ja Puu (Papper och Tra), Vol. 57, No. 10, p 666-668, Oct., 1975. 10 ref, 2 tab. English summa-

Descriptors: *Bark, *Water pollution sources, *Insecticides, Wood waste, Pollutants, Wastes, Water pollution, *Industrial wastes, Chlorinated hydrocarbon pesticides, Foreign research, Foreign

nyurocarbon pesticiues, roreign research, roreign countries, Legislation Identifiers: Lindane(Gamma-isomer of HCH), Barking effluent, Finland, Pulpwood, Hexachloro-cyclohexane(Benzene hexachloride BHC HCH).

Unbarked green pine pulpwood logs were sprayed with 1.1 liter of lindane (0.4% gamma-HCH) per solid cu m in the spring of 1974 and barked in a drum barker 2 months later. The lindane level in the bark averaged 11 mg/kg of dry matter before barking and less than one-half of this after barking. In the waste water the lindane concentration was 0.06-0.10 mg/liter. According to Finnish environ-mental legislation, insecticide-sprayed wood must not be barked in a wet (hydraulic) drum barker if there is any probability of the effluent entering natural waterways. (Brown-IPC). W76-05734

EFFECTIVE USE OF HIGH WATER TABLE AREAS FOR SANITARY LANDFILL. VOL. II, VTN, Inc., Orlando, Fla.

For primary bibliographic entry see Field 5G. W76-05744

IMPACT OF COAL STRIP MINING ON WATER QUALITY AND HYDROLOGY OF EAST TEN-

Tennessee Univ., Knoxville. Dept. of Civil Engineering.

A. Tschantz, and A. Minear. Available from the National Technical Informa tion Service, Springfield, Va 22161 as PB-251 391, \$4.50 in paper copy, \$2.25 in microfiche. OWRT A041-Tenn. (1) 14-31-0001-5043 Tennessee Water Resources Research Center, Knoxville, Report No. 47, November 30, 1975. 46 p, 19 fig, 5 tab, 16

Descriptors: Water quality, Hydrology, Strip mining, *Monitoring, *Heavy metals, *Coal mine wastes, *Strip mine wastes, Mine drainage, *Tennessee, Watersheds(Basins), *Path of pollutants, Pollutant identification. Identifiers: New River Basin(Tenn).

Six small watersheds (0.7 to 4.9 sq.mi.) within the New River Basin of the Northern Tennessee Cumberland Mountains have been monitored weekly and simultaneously for water quality between January and September, 1975. Three watersheds were undisturbed by mining activity and served to establish bench mark data. The other three watersheds represented varying stages of coal mining in one watershed to essentially complete stripping three years ago and current deep mining activity in another. Distinct differences are observed were the variables, pH, alkalinity, sulfate, calcium, magnesium, iron manganeses, total solids and suspended solids among the disturbed watersheds in contrast to the undisturbed watershed where stream constituent concentrations were quite uniform from stream to stream and from sample to sample. Preliminary data on the heavy metals, Cd, Cr, Co, Cu, Pb, Ni and Zn, indicate increased metal levels in the disturbed streams, principally in particulate form.

W76-05833

MODELING THE EFFECT OF WASTE DISCHARGES IN A SMALL MOUNTAIN

STREAM, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.

R. C. Hoehn, M. R. Childney, and D. N.

Contractor.

Available from the National Technical Information Service Springfield, Va 22161 as PB-251 392, \$5.00 in paper copy, \$2.25 in microfiche. Virginia Water Resources Research Center, Blacksburg, VWRRC Bulletin 76, September 1975. 94 p, 21 fig, 5 tab, 14 ref, 4 append.

Descriptors: *Computer Models, *Dissolved Ox-ygen, *Biological Oxygen Demand, Streams, Mountains, Computers, Model studies, *Virginia, *Forecasting, *Path of pollutants, Water pollution

Identifiers: Sensitivity Analysis, Computer Pre-

This research evaluated the applicability of a particular computer model, designed to predict dis-solved oxygen (DO) and biochemical oxygen demand (BOD) concentrations in rivers, to similar studies of a small mountain stream in southwestern Virginia. The river model was developed by Virginia State Water Control Board's Bureau of Water Control Management. A detailed explanation of the necessary computa-tions involved, the methods used to obtain all necessary input data, and modifications that were made in the original model to adapt it for use with a small stream. Also included is a discussion of a modified sensitivity analysis of the model per-formed to identify which input parameters, if varied slightly, would affect the model's DO and BOD predictions. Finally, data are presented showing that the modified version of the model is capable of predicting measured DO and BOD concentrations in the stream.

SALT TRANSPORT IN SOIL PROFILES WITH APPLICATION TO IRRIGATION RETURN FLOW, THE DISSOLUTION AND TRANSPORT OF GYPSUM IN SOILS, Colorado State Univ., Fort Collins. Dept. of

Agronomy.

T. K. Glas, and D. B. McWhorter.

Available from the National Technical Informa tion Service, Springfield, Va 22161 as PB-251 373, \$5.50 in paper copy, \$2.25 in microfiche. Colorado Environmental Resources Center, Fort Collins, Completion Report Series No. 71, January 1976. 88 p, 31 fig, 9 tab, 49 ref. OWRT A-017-COLO(1).

Descriptors: *Leaching, Water quality, Percolation, Equations, Dispersion, Convection, Salts, *Soil profiles, *Return flow, Irrigation, *Gypsum, Calcium sulfate, Soil water movement, Kinetics, Model studies, Dissolved solids. Identifiers: *Salt transport, Salt removal.

The dissolution of gypsum and the subsequent transport of the dissolved species in a soil-water system was studied by measuring the calcium concentration in the solution phase as a function of time at different positions in columns filled with a soil-gypsum mixture that were leached with distilled water. Two soils, a range of flow rates of the solution phase, solution contents and particle sizes of the gypsum material were used. The measured concentration-time curves were compared with results from a mixing cell-equilibrium chemical model, and the convection-dispersion equation combined with a first-order kinetic rate equation to describe the gypsum dissolution process. The rate equation was based on the hypothesis that the rate of dissolution was proportional to the product of the saturation deficit and a function of the mass of gypsum present in the system. Values of the kinetic parameters were selected to obtain the best possible agreement between the measured concentration-time curves and concentration-time curves calculated from the kinetic model. The dissolution reaction of the gypsum was time dependent and was not controlled by the solubility product relationship, as assumed in the mixing cell model. W76-05836 SOME OF THE EFFECTS OF DOMESTIC SEWAGE DISCHARGE INTO HICKMAN AND JESSAMINE CREEKS IN JESSAMINE COUN-

JESSAMINE CREEKS IN JESSAMINE COUNTY, KENTUCKY,
Asbury Coll., Wilmore, Ky.
H. H. Howell, and M. W. Jones.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 378,
\$4.00 in paper copy, \$2.25 in microfiche. OWRT
A-999-Ky (3) 14-34-0001-6018 Kentucky Water
Resources Research Institute, Lexington,
Research Report No. 93, February, 1976. 26 p, 2 fig. 6 tab. 22 ref.

Descriptors: Water pollution, Streams, Benthos, Benthos, Fish, *Kentucky, Sewage, Domestic wastes, Waste disposal, Sewage disposal, Treat-ment facilities, Phosphates, Sulfates, Nitrates, Bioindicators, Path of pollutants. Identifiers: Stream order, Hickman Creek(Ky), Jessamine Creek(Ky).

A six-week study was made in the summer of 1971 as an initial effort to determine the extent of pollution that the three sewage disposal plants in Jessamine County, Kentucky, are contributing to its streams. With the rapid population increase in Lexington and nearby municipalities, this study should furnish a basis of comparison for future investigations. Eighteen collecting stations were established in riffle areas of Hickman and Jesestablished in ITHE areas of Hickman and Jes-samine Creeks, and coliform bacteria, macro-in-vertebrate populations, fish populations and chemical water quality of each riffle area were stu-died. Hickman Creek's flow was augmented by ap-proximately 3,100,000 gallon/day (11,735 m3/day) from one of the City of Lexington's sewage disposal plants, and Jessamine Creek's flow by 500,000 gallons/day (1,893 m3/day) from the cities of Nicholasville and Wilmore. The Lexington and Wilmore facilities were greatly overloaded. Chemical analysis were directed toward finding out fluctuations of phosphates, sulfates, and nitrates. Water disappearing through limestone faults posed investigational problems. Hickman Creek showed evidences of pollution for a greater distance than did Jessamine. Diversity of clean water indicator organisms was higher in lower Jessamine than in lower Hickman; this was particularly true for darters and stoneflies. (Huffsey-Kentucky) W76-05841

STEADY-STATE SEGMENTED DISSOLVED-

OXYGEN MODEL,
Geological Survey, Bay Saint Louis, Miss.
D. P. Bauer, and M. E. Jennings.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-241 779, \$5.50 in paper copy, \$2.25 in microfiche. Computer Contribution Report USGS/WRD-75/027, May 1975. 96 p, 2 fig, 5 ref.

Descriptors: *Mathematical models, *Oxygen sag, *Path of pollutants, *Wastes, *Streams, Computer models, *Computer programs, Synthetic hydrology, Numerical analysis, Methodology, Biological properties, Chemical properties, *Dissolved oxygen, Biochemical oxygen demand, Forecasting, *Accorption conditions*

Anaerobic conditions.

Identifiers: Streeter-Phelps, One-dimensional, Bell method, Linear runoff.

A digital model which predicts stream biochemical characteristics from waste source inputs is described. The program is developed using the basic Streeter-Phelps equation. This formulation assumes a one-dimensional system and constant stream and waste flows. Variables which are pre-dicted include dissolved oxygen, biochemical oxygen demand, and various conservative minerals. In modeling a stream reach, the program user can break the reach into as many subreaches as desired. Summary results from the model are broken into tabulations at fixed distance intervals downstream. For given subreaches the user is allowed to specify waste or tributary inflow at the

Group 5B-Sources Of Pollution

start of the subreach and (or) linear runoff along the subreach. Output from the program is also modified by the addition of line-printer plots and expanded line-printer output tabulations. Editing of the input data is also included. (Woodard-USGS) W76-05855

HYDROGEOCHEMICAL DATA FROM IN-VESTIGATION OF WATER QUALITY IN SEWERED AND UNSEWERED AREAS, SOUTHERN NASSAU COUNTY, LONG LONG ISLAND, NEW YORK,

Geological Survey, Mineola, N.Y. For primary bibliographic entry see Field 7C. W76-05858

COMPILATION OF METHODOLOGY USED FOR MEASURING POLLUTION PARAMETERS OF SANITARY LANDFILL LEACHATE, Illinois Univ. at Urbana-Champaign. Dept. of Civil

Engineering. For primary bibliographic entry see Field 5A. W76-05869

RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT -ECOLOGY, JANUARY-DECEMBER 1974. Argonne National Lab., Ill. Radiological and Environmental Research Div.

For primary bibliographic entry see Field 5C. W76-05879

ROLE OF COPEPOD FECAL PELLETS IN THE VERTICAL TRANSPORT OF FRESHWATER

Argonne National Lab., Ill. Radioological and Environmental Research Div.

For primary bibliographic entry see Field 5C. W76-05880

VERTICAL TRANSPORT OF PARTICULATE MATERIAL IN LAKE MICHIGAN BY THE LORICA OF CODONELLA CRATERA,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5C. W76-05881

DISTRIBUTION OF DIATOM FRUSTULES IN LAKE MICHIGAN SEDIMENT CORES, Argonne National Lab., Argonne, Ill. Radiological

and Environmental Research Div. For primary bibliographic entry see Field 5C. W76-05882

DISTRIBUTION OF AMORPHOUS, DIATOM FRUSTULE, AND DISSOLVED SILICA IN A LEAD-210 DATED CORE FROM SOUTHERN LAKE MICHIGAN, Argonne National Lab., Argonne, Ill. Radiological

and Environmental Research Div. For primary bibliographic entry see Field 5C.

W76-05883

STABLE LEAD GEOCHRONOLOGY OF FINE-GRAINED SEDIMENTS IN SOUTHERN LAKE MICHIGAN.

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. J. A. Robbins, and D. N. Edgington.

Division Annual Report-Ecology, January through December 1974. p 32-39, (1975). 4 fig, 1 tab, 13 ref. W-31-109-Eng-38. In: Radiological and Environmental Research

Descriptors: *Environmental effects, *Lead, Sediments, *Cores, Air pollution, Distribution, ments, *Cores, Air pollution, Distribution, Aerosols, Coals, Gasoline, Lake Michigan, Model studies, *Lake sediments, Lakes. Identifiers: *Geochronology, Combustion, Cultural lead.

The lead distributions in dated cores are quantitatively described by a universal time-dependent loading or source function which is a linear combination of estimated annual inputs of atmospheric lead derived from the combustion of leaded gasoline and the burning of coal in and around Chicago since about 1800. A source function model which assumes that lead has a negligible residence time in water and negligible postdeposi-tional chemical or diffusional mobility was derived. It was also assumed that atmospheric inputs were the major source of cultural lead in the sediments and that other sources were propor-tional to the atmospheric inputs. The modelderived parameters of sedimentation rate, mixing depth, and 1972 cultural lead were applied to study Illinois Geological Survey cores from southern Lake Michigan. (See also W76-05879) (Chilton-ORNL) W76-05884

GEOCHRONOLOGY OF LAKE MICHIGAN SEDIMENTS: ANOMALIES IN LEAD-210 DIS-TRIBUTIONS.

Michigan Univ., Ann Arbor. J. A. Robbins, D. N. Edgington, J. Gustinis, and J.

O. Karttunen.

In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 40-50, (1975). 3 fig, 1 tab, 8 ref. W-31-109-Eng-38.

Descriptors: *Environmental effects, *Lead, *Distribution, Sediments, Cores, Lake Michigan, *Lake sediments, Lakes. Identifiers: *Geochronology.

Measurements of Pb210 and Cs137 and stable lead were made on a series of 10 cores. In nearly every core, significant subsurface anomalies occur. showing that nonexponential and presently uninterpretable features are the rule rather than the exception in fine-grained sediments from southern Lake Michigan. It is suggested that the anomalies are the result of some event common to at least several of the Great Lakes. Regional causes such as major storms, floods, droughts, changes in lake levels, or changing land use may influence inputs of terrigenous materials to the lake. Changes in the depth of a surficial mixing zone due to bioturba-tion or the structure of bottom currents could produce anomalies. It was concluded that studies of the behavior of lead in lacustrine environments should include delineation of sources of lead and sediments and their spatial and temporal variations, spatial variation of anomalies over the lake bottom, and chemical mobility of lead in the sediments. (See also W76-05879) (Chilton-ORNL) W76-05885

MIAMI RIVER WATERSHED PROJECT: IN-TRODUCTION,

Argonne National Lab., Argonne, Ill. Radiological

and Environmental Research Div. R. N. Muller, D. G. Sprugel, and D. N. Edgington. In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 69-71, (1975). W-31-109-Eng-38.

Descriptors: *Watersheds(Basins), Physical properties, *Ohio, *Plutonium, Environmental ef-Projects, *Path of pollutants.

Radioisotopes.
Identifiers: *Miami River Watershed Pro-

The project was designed to study cycling characteristics of plutonium in the humid eastern portions of the United States. The watershed, located in southwestern Ohio, encompasses about 5400 square miles. Daily mean temperatures range from 2 degrees C to 25 degrees C. Annual precipitation averages 90 cm. Land use is predominantly

agricultural with an extensive industrial base between Dayton and Cincinnati. The topography is rolling and formed from a thick mantle of glacial till underlain by limestone, dolomite, and calcareous shale. The soil is generally silt loam with moderately good drainage and a pH ranging from neutral to slightly acid. Three primary isotopes of plutonium, Pu238, Pu239, and Pu240, are present in the watershed but the levels of these isotopes in the environment are so low that study of their cycling characteristics is difficult. (See also W76-05879) (Chilton-ORNL) W76-05886

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PLUTONIUM CONCENTRATIONS IN WATER AND SUSPENDED SEDIMENT FROM THE MIAMI RIVER WATERSHED, OHIO, Argonne National Lab., Argonne, Ill. Radiological

and Environmental Research Div. G. E. Bartelt, C. W. Wayman, and D. N.

Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974, p 72-77, (1975). 3 tab, 5 ref. W-31-109-Eng-38

Descriptors: *Watershed(Basins), *Plutonium, *Radioisotopes, *Ohio, Sediments.
Identifiers: *Miami River Watershed Pro-Identifiers: iect(Ohio).

The primary goals were to identify sources and sinks of plutonium in the Miami River Watershed, and to determine spatial and temporal variability in concentrations of the different plutonium isotopes. The major source of Pu238 is the direct discharge to the Miami River from the sanitary water treatment plant at Mound Laboratory. Significant concentrations may also result from the erosion of Pu238 enriched sediment from contaminated ponds and canal area near Mound and from fallout from the laboratory's stacks with subsequent erosion and runoff into the river. Concentrations of Pu238, Pu239, and Pu240 increased greatly during rainy periods. This increase was probably due to surface erosion of soil containing Pu and subsequent loading of the streams with sediment. (See also W76-05879) (Chilton-ORNL) W76-05887

PLUTONIUM IN AQUATIC BIOTA OF THE GREAT MIAMI RIVER WATERSHED, OHIO. Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div For primary bibliographic entry see Field 5C. W76-05888

THE CHEMICAL SPECIATION OF PU-239, PU-240 AND CS-137 IN LAKE MICHIGAN WATERS, Argonne National Lab., Argonne, Ill. Radiological

and Environmental Research Div J. J. Alberts, M. A. Wahlgren, P. J. Jehn, D. M. Nelson, and K. A. Orlandini.

In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 89-96, (1975) 2 tab, 4 ref. W-31-109-Eng-38.

Descriptors: *Plutonium, *Cesium, Chemistry, *Water pollution, *Radioisotopes, Fallout, Parti-cle size, Lake Michigan, Lakes, Distribution.

Studies of the submicron size distribution and charge characteristics of naturally occurring levels of Pu239, Pu240 and Cs137 were undertaken to help define the physicochemical state of these fal-lout derived nuclides in Lake Michigan waters and in precipitation samples taken in the Argonne Laboratory area. The work indicates that the radioisotopes exist in several different fractions within the water column and that the total charge of these fractions is different from what would be predicted by simple solution chemistry. The dis-tribution of these isotopes in snow is different

from that in the water column, indicating that considerable chemical and/or physical transforma-tions must take place after the atmospheric input has reached the lake surface. Insufficient data processes or to give quantitative values for the individual fractions present in the waters. Work is continuing on these problems. (See also W76-05879) (Chilton-ORNL) were available to determine rate constants for the W76-05889

SEDIMENTARY PU-239, PU-240 PHASE DISTRIBUTIONS IN LAKE MICHIGAN SEDI-

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.
J. J. Alberts, M. A. Wahlgren, C. A. Reeve, and P.

J. Jehn.

In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974, p 103-112, (1975). 1 fig, 2 tab, 8 ref. W-31-109-Eng-38.

Descriptors: *Plutonium, Environment, Sediments, Deposition(Sediments), Chemistry Suspension, *Radioisotopes, Lake Michigan, Lim nology, *Lake sediments, Lakes, *Distribution. Chemistry. Identifiers: Cycling, Nuclear studies.

The purpose was to better understand the cycling and fate of plutonium isotopes in the natural environment, with the goal of forming a predictive model for a hypothetical accident involving nuclear materials. Sediment grab samples were obtained along a transect starting in the Grand River (Michigan) and extending into deep water of Lake Michigan. The sediments were then subjected to a series of extractions designed to differentiate material which exists in the ion exchangeable, reductant-soluble, organic, and crystalline phases within the sediment. Concentrations of Pu 239, 240 were low in all samples. The study indicated that Pu 239, 240 in Lake Michigan is relatively immobile and that essentially none is in the form of refractory particles. (See also W76-05879) (Chilton-ORNL) W76-05891

THE DISTRIBUTION OF PLUTONIUM IN

LAKE MICHIGAN SEDIMENTS, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

J. O. Karttunen, and D. N. Edgington.
In: Radiological and Environmental Research

Division Annual Report-Ecology, January through December 1974, p 113-127, (1975) 10 fig, 2 tab, 19 ref. W-31-109-Eng-38.

Descriptors: *Plutonium. *Sediments. Sedimentation *Distribution. rates. *Radioisotopes, Baseline studies, Lake Michigan, Limnology, *Lake sediments, Lakes. Identifiers: *Nuclear studies.

Core samples were collected and studied to (1) provide baseline information as to the present content of plutonium in sediments from Lake Michigan, (2) determine the utility of plutonium isotopes for estimating sedimentation rates, (3) assess the extent of additional radionuclide inputs, and (4) determine the vertical distribution in recent sediments. High depositions of plutonium were found to occur to the north and west of major river inputs with the greater part of the radioactivity being concentrated in the sediments of the eastern half of the lake. In the southern half of the lake where the bottom topography indicates an almost continuous slope to a maximum depth of 540 ft. the maximum depth of sediment occurs at a water depth of only 240 ft. No sedimentation occurs at water depths less than 150 ft. Therefore, very little radioactivity is being deposited in the nearshore zone. The deposition of radioactivity is apparently being controlled by lake-wide processes. (See also W76-05879) (Chilton-ORNL)

IN DEVELOPMENTS UNDERWATER RADIOTELEMETRY AND PRELIMINARY FISH TRACKING IN THERMAL PLUMES. Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

For primary bibliographic entry see Field 5C. W76-05893

COMPARISON OF THE MOVEMENT AND RECAPTURE OF SALMONID FISHES TAGGED AT TWO POWER PLANTS,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5C.

ORIGIN OF FIN-CLIPPED SALMONIDS COL-

DRIGHT OF THE CLIFFED SALMONDS COL-LECTED AT TWO THERMAL DISCHARGES ON LAKE MICHIGAN, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5C. W76-05895

CONTAMINATION OF FRESHWATER BY MN54 AND CO60,

Commission of the European Communities, Brussels (Belgium); and Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). For primary bibliographic entry see Field 5C.

SOLUTE TRAVEL-TIME ESTIMATES FOR TILE-DRAINED FIELDS: I. THEORY,

California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.

Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1020-1024, November-December 1975. 6 fig. 14 ref.

*Leaching, *Water quality Descriptors: *Effluents, *Drainage water, *Solutes, *Path of pollutants, Pollutants, Mathematical models, Forecasting, Wastes, Fertilizers, Water pollution sources, Tiles, Drains, Excess water(Soils). Identifiers: *Miscible displacement, Effluent concentration, Convective flow, Steady-state system.

A model based on papers by D. Kirkham (1949, 1958) was proposed for calculating solute travel times and effluent water quality for tile-drained soil profiles for cases of ponded and unsaturated surface water input. Variables required for utilization of the model were drain spacing, depth of tile, depth to impermeable zone, soil porosity, and mean discharge rate over the time of study. By using dimensionless variables a characteristic travel-time parameter was introduced which represented a system and allowed the model calculations to be summarized on a single graph. Simulations were run for cases of miscible displace-ment, step-function surface solute input, and periodic surface solute input; differences between ponded and unsaturated leaching were discussed for tile systems. (See also W76-05905) (Sanderson - ISWS) W76-05904

SOLUTE TRAVEL-TIME ESTIMATE FOR TILE-DRAINED FIELDS: III. APPLICATION TO EXPERIMENTAL STUDIES, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.

W. A. Jury.

Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1024-1028, November-December 1975. 3 fig. 5 tab. 11 ref.

*Effluents, *Drainage water, *Solutes, *Path of pollutants, Pollutants, Mathematical Forecasting, Waster Fertilizers Water Forecasting, Wastes, Fertilizers, Water pollution

sources, Tiles, Drains, Excess water(Soils), Moni-

toring, Data collections, Legislation.
Identifiers: *Miscible displacement, Effluent concentration, Effluent monitoring, Convective flow, Steady-state system.

The model of Jury (1975) for estimating travel time from surface application to point of discharge for tile-drained fields was applied to data from published studies of tile-drain effluent concentrations and solute flux. In all systems the observed values were consistent with model calculations, and in circumstances where an exact comparison was possible the agreement between measured and predicted values was very good. Measures proposed for improving water quality by requiring standards for effluent discharge levels were discussed and criticized, and model simulations of projected monitoring policies of typical field systems were used to demonstrate the potential for misinterpreting the relationship between surface inputs and output levels. (See also W76-05904) (Sanderson - ISWS)

EFFECT OF SURFACE APPLIED SULFURIC ACID ON WATER PENETRATION INTO DRY CALCAREOUS AND SODIC SOILS,

Arizona Univ., Tuscon. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 5G.

MULTIVARIATE SYNTHETIC HYDROLOGY,

Centro di Ricerca IBM di Pisa (Italy). For primary bibliographic entry see Field 2A. W76-05909

USING PARAMETRIC MODELS OF RUNOFF TO IMPROVE PARAMETER ESTIMATES FOR STOCHASTIC MODELS.

Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2E. W76-05911

NUCLEAR TECHNIQUES IN HYDROLOGY-CURRENT STATUS AND PROSPECTIVE USES. National Academy of Sciences, Washington, D.C.; National Committee for the International Hydrological Decade, Washington, D.C. For primary bibliographic entry see Field 5A. W76-05922

HYDROLOGIC ASPECTS OF URBANIZATION, For primary bibliographic entry see Field 4C W76-05925

EFFECT OF URBANIZATION ON THE QUALI-TY OF RIVER WATER.

B. G. Skakal'skiy.

Soviet Hydrology, Selected Papers, No. 5, p 413-420, 1973. 4 fig, 4 tab, 28 ref. Translated from Transactions of the State Hydrologic Institute (Trudy Gossudarstvennogo Gidrologicheskogo Instituta), No. 206, p 134-145, 1973.

Descriptors: *Urbanization, *Water quality, *Rivers, Sewage effluents, Industrial wastes, Domestic wastes, Detergents, Runoff, Urban runoff, Biochemical oxygen demand, Nutrients, Pollutants, Water pollution, Surface waters.

In our time of rapid economic development and population growth, the effect of human activity on nature has increased sharply and spread to all natural environmental components, leading to their deterioration in some cases. The increase in the utilization of natural resources not only threatens their exhaustion in some cases, but may be accompanied by pollution because of the in

Group 5B-Sources Of Pollution

creasing amount of waste. One of the most important problems to arise is that of meeting the in-creasing requirements of the population and various branches of the economy for water resources of adequate quality under conditions of waste water disposal into natural bodies of water. Pollution of the hydrosphere is an undesirable effect of many aspects of economic development, including industrialization, urbanization, the development of transportation, and also reclamation and the chemicalization of agriculture. Some aspects of the effect of urbanization on the quality of natural surface waters were examined on the basis of Soviet and foreign investigations. (Sims-ISWS)

SOIL MICROBES, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 2G.

SOIL PROCESSES AND INTRODUCED CHEMI-

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4C. W76-05936

SOIL STABILITY AND WATER YIELD AND QUALITY.

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4D.

EFFECTS OF FOREST FERTILIZATION WITH UREA ON STREAM WATER QUALITY--QUIL-CENE RANGER DISTRICT, WASHINGTON, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station.

D. G. Moore Research Note PNW-241, March 1975. 9 p, 1 fig, 3

Descriptors: *Fertilization, Water analysis, *Water quality, Forest management, *Ureas, Descriptors:

*Washington, National forests. Identifiers: *Olympic National Forest(Wash).

Aerial fertilization of two units on the Quilcene Ranger District of the Olympic National Forest with urea at 224 kilograms nitrogen per hectare (200 pounds nitrogen per acre) in April 1970 provided the opportunity to monitor water quality in small streams immediately adjacent of the treated areas. Applied fertilizer did reach surface streams in the form of urea-, ammonia-, and nitrate-nitrogen, but maximum concentrations measured were well below established permissible limits for public water supplies. Concentrations of urea-N never reached 1.0 part per million, ammonia-N increased only slightly above background, and the highest level of nitrate-N found was 0.121 part per million. Fertilizer nitrogen entered streams only in the form of nitrate after the first 3 weeks, and 95 percent of the total loss over 7 months occurred within the first 9 weeks after application. Fertilizer nitrogen lost during the 7-month monitoring period was about 0.25 percent of the total applied. Introduction of these small amounts of nitrogen into forest streams spread out over a period of several weeks should have little measurable impact on eutrophication. (Forest Service) W76-05938

DEMAND FOR DISSOLVED OXYGEN EXERTED BY FINELY DIVIDED LOGGING DEBRIS IN STREAMS,

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 4C. W76-05939

TIMBER PRODUCTION AND WATER QUALI-TY -- PROGRESS IN PLANNING FOR THE BULL RUN, PORTLAND, OREGON'S MU-NICIPAL WATERSHED, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station. R. L. Fredriksen, and R. N. Ross.

In: Forestry Issues in Urban America, Proceedings, 1974 National Convention, Society of American Foresters, New York City, Sept. 22-26, 1974, p. 168-186, 8 fig. 3 tab, 19 ref.

*Land management, *Planning, Descriptors: *Watersheds(Basins), Soil erosion, Slope stability, Nutrient removal, Turbidity, *Water quality, *Lumbering, Water temperature, *Oregon, *Land

Identifiers: Land use planning, Bacteriological quality, Bull Run watershed(Ore).

The land use planning process is discussed with a description given of how available research information can be used in land use planning as demon strated on the Bull Run Watershed. The detail presented is only a portion of the extensive data used in arriving at an overall management direction for this important watershed. Surface water features of the watershed must be dealt with differently than the land units. As live streams are linear, they do not lend themselves to area representation on a map or in the computer. A representation on a map of in the compatible, separate but compatible system of representation must be employed. The planning process described is new and evolving. It is being tested along with other approaches in use throughout the country. Evaluation and refinement of the plan must be done. Nutrient enrichment, bacteriological quality, and the effect of reservoirs as a source or a sink are areas needing further study. (Forest Service) W76-05942

IMPACT OF FOREST FERTILIZATION ON WATER QUALITY IN THE DOUGLAS-FIR RE-GION -- A SUMMARY OF MONITORING STU-DIES.

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. D. G. Moore.

In: Forestry Issues in Urban Proceedings, 1974 National Convention, Society of American Foresters, New York City, Sept. 22-26, 1974. p. 209-219. 2 fig, 4 tab, 11 ref.

Descriptors: Ureas, Nitrates, Nitrites, Ammonia, *Forest management, *Fertilization, Eutrophica-tion, *Water quality, *Watershed management, Leaching, *Douglas fir trees, Pacific Northwest

Forest fertilization on a commercial scale began in the Pacific Northwest in 1965. Between 1965 and 1969, 36,000 ha were fertilized in western Oregon and Washington. By 1974 this figure had increased to over 285,000 ha. The annual rate of fertilization for the region is approaching 120,000 ha. Coincident with the development of forest fertilization as a management tool, there has been a growing and equally important concern over the possibility of detrimental effects on water quality. Federal and State agencies and private industry have conducted a number of monitoring studies throughout the Douglas-fir region over the past 6 years. Some 29 forest fertilization projects have been monitored covering a wide range of soils, climate and vegetation zones. In most fertilizer applications, urea, ammonium, and nitrate nitrogen are found in streams flowing through areas which are treated. Nitrite nitrogen is not detected. Peak concentrations of urea nitrogen do not persist for more than a few hours, ammonium levels increase as a result of the direct application of urea to open water, and concentrations of nitrate nitrogen in streams usually reach a peak in 2 to 4 days, then decrease to background levels. Maximum concentrations of urea, ammonium, and nitrate nitrogen measured in streams following forest fertilization have not ap-

proached levels considered unacceptable in public water supplies. The total amounts of applied nitrogen entering streams draining fertilized forest areas are relatively small and should not have any measurable impact on eutrophication in downstream impoundments. (Forest Service) W76-05943

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SOUTHERN FORESTS: A HARVESTING THREAT TO WATER QUALITY

Forest Service (USDA), Oxford, Miss. Southern Forest Experiment Station.

In: Non-Point Sources of Water Pollution, n. 145-151. 1975. 25 refs. Proceedings of Southeastern Regional Conference conducted at Virginia Polytechnic Institute and State University, Blacksburg, Va.

Descriptors: *Water yield, *Streamflow, *Water quality, *Sediment yield, *Coastal Plains, *Gulf Coastal Plain, Watershed management, Interception, Loblolly pine trees, Water resources, Groundwater recharge, Overland flow, Forest management, Pine trees, Harvesting, Water pollu-

tion, Water quality standards, Mississippi.
Identifiers: Site preparation, Sediment production, Harvesting practices, Logging practices, Skidding, Logging roads, Water quality legislation.

Pending regulations under existing legislation make water pollution from forest management activities increasingly significant. A potential con-flict exists between the need to increase wood production at competitive costs and the achievement of proposed water quality standards. The impacts of harvesting on water quality in the South have not been quantified, but they are known to be short-lived. Forest managers cannot plan to meet objectives nor can needed research be effective until the standards and how they will be applied are defined. For southern forest conditions, research needs include: the influence of prior agricultural use on water quality unrelated to present forest practices, the natural variations in a forest ecosystem, the intended use of the water affected, and the temporary effects of infrequent disturbances. (Forest Service) W76-05945

PESTICIDE RESIDUE DYNAMICS IN FOREST ECOSYSTEM: A COMPARTMENT MODEL

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. W. L. Webb, H. J. Schroeder, Jr., and L.A. Norris. Simulation, Vol. 24, No. 6, p. 161-169, 1975. 9 fig, 2 tab. 7 ref.

Descriptors: *Pesticides, *Herbicides, *Pesticides, *Pest *Pesticide residues, models, *Herbicides, 2,4,5-T, Ecosystems, Environmental effects, Toxicity. Seasonal, Forest management, Model studies, Computer programs, Oregon, California. Identifiers: Seasonal changes.

A computer model of the movement of pesticide residues in a forest ecosystem is described. The potential direct effects on target and nontarget organisms are emphasized; the very long-term consequences of restructuring the vegetation in an ecosystem are not discussed. Simulations using the model trace the movement of two herbicides (2,4,5-T and picloram) through two different environments, one typical of an Oregon forest and the other typical of southern California chaparral. The model is written in DYNAMO. (Forest Ser-W76-05946

DICAMBA RESIDUES IN STREAMS AFTER FOREST SPRAYING.

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. L. A. Norris, and M. L. Montgomery.

Bulletin of Environmental Contamination and Toxicology, Vol. 13, No. 1, p 1-8, 1975. 3 fig, 1 tab,

Descriptors: *Chemcontrol, *Brush control, Herbicides, Path of pollutants, Water pollution

Identifiers: *Chemical brush control, *Dicamba, *Herbicide Residues, Forest spraying.

Aerial application of 1.12 kg dicamba and 2.24 kg 2.4-D per hectare in 37.8 L of water resulted in measurable residues of dicamba in water. Samples were not analyzed for 2,4-D. A maximum dicamba concentration of 37 ppb occurred 5.2 hr after application. The concentration fell rapidly and reached background levels 37 hr after application. Approx-imately 3 days after application a small increase in concentration to a maximum level of 9 ppb occurred in connection with a small rainstorm. Herbicide concentration levels were markedly reduced with time and distance downstream. Sampling continued for more than a year after application, but detectable residues were not found more than 11 days after application. The dicamba residues detected in this study pose no acute hazard to aquatic organisms or to downstream water users. Short persistence of the herbicide in the water precludes chronic exposure. (Forest Ser-W76-05949

MOLYBDENUM IN A NEARSHORE AND ESTUARINE ENVIRONMENT, NORTH WALES. Southampton Univ. (England). Dept. of Oceanog-

For primary bibliographic entry see Field 2K.

WATER AND PHOSPHATE TRANSPORT TO PLANT ROOTS,

Veterinary and Royal Agriculture Copenhagen (Denmark). Hydrotechnical Lab. For primary bibliographic entry see Field 21.

CHEMICAL CHARACTERIZATION OF INDUS-TRIAL WASTEWATERS BY GAS CHRO-MATOGRAPHY-MASS SPECTROMETRY, Environmental Research Lab., Athens, Ga. For primary bibliographic entry see Field 5A.

CAUSE AND IDENTIFICATION OF TASTE AND ODOUR COMPOUNDS IN WATER, Rijksinstituut voor Drinkwatervoorziening, The

Hague (Netherlands). For primary bibliographic entry see Field 5A. W76-06009

W76-06008

OCCURRENCE OF PHYTOPHTHORA SPECIES AND OTHER POTENTIAL PLANT PATHOGENS IN RECYCLED IRRIGATION

California Univ., Berkeley. Dept. of Plant Patholo-

gy. For primary bibliographic entry see Field 5C. W76-06010

DISTRIBUTION AND STRUCTURE OF BENTHIC ASSEMBLAGES IN PUGET SOUND, WASHINGTON, USA,

United Nations Educational, Scientific, and Cultural Organization, Paris (France).

Mar Biol (Berl), 26(3): 203-223, 1974.

Descriptors: *Benthic fauna, *Distribution pat-terns, *Washington, Salinity, Sounds, Tempera-ture, Crustaceans, Particle size, Water pollution, Hypolimnion, Bottom sediments. Identifiers: Echinoderm, Lamellibranch, *Puget Sound(Wash).

Benthic infauna was collected with a 0.2 m2 van Veen grab at 48 stations in Puget Sound, Washington, during Feb.-March 1969. All the crustaceans. lamellibranchs, and echinoderms were identified and counted. Particle size, distributions and N contents of the sediments, depths and temperature and salinity of the bottom water were determined at all stations. The first 3 factors of a factor analysis applied to between-station measures of affinity, explained 41.26% of the total variance. The 1st factor had representative stations on shallowwater mud bottoms, the 2nd factor on bottoms dominated by coarse sediments and the 3rd factor had representative stations on deep-water mud bottoms. The factor analysis did not result in clusters of stations that could be interpreted as discrete benthic communities. The frequency distribution of specimens among the species was in good agreement with a log-normal distribution.

The species diversity ranged from 0.34 bits/individual to 4.35 bits/individual and there was a weak trend of increasing diversity towards coarser sediments. The 1st 3 factors applied to the matrix of between-species correlation coefficients explained 43.72% of the total variance. Each group of species could be identified with particular en vironments. Only about 24% of the variability in standing crop could be attributed to variability in sediment types, N content in the sediments, salinity of the bottom water and depth .-- Copyright 1975, Biological Abstracts, Inc. W76-06015

CHANGES IN THE LIMNOLOGICAL FEATURES OF A MEROMICTIC LAKE SUIGETSU DURING THE YEARS, 1926-1967,

Nagoya Univ. (Japan). Water Research Lab. For primary bibliographic entry see Field 2H. W76-06018

ON THE POSSIBILITIES OF AVERAGING THE SEASONAL PATTERN IN KJELDAH NITROGEN IN A GROUP OF WATER BODIES, Ceskoslovenska Akademie Ved. Prague. Hydrobiologicka Laborator. I. Hrbacek

Int Rev Gesamten Hydrobiol, 59(3): 395-402, 1974.

Descriptors: *Nitrogen, *Ponds, *Seasonal, Identifiers: *Kjeldahl nitrogen.

It is shown that the seasonal change of Kjeldahl N in several ponds and several years shows an average seasonal change which is statistically significant on a month-to-month basis although not apparent at first sight. The relative deviation of Kjeldahl N values in individual months and individual ponds from seasonal averages of individual ponds is closer to lognormal than to normal distribution. The seasonal curve based on average values of relative deviations in individual months and ponds from the seasonal averages of individual ponds shows the lowest variation of average monthly values and is therefore most adequate to a comparison of the seasonal pattern of two or more groups of water bodies.--Copyright 1975, Biological Abstracts, Inc.

TRACE METALS IN THE WATERS OF THE GULF OF ST. LAWRENCE, Bedford Inst., Dartmouth (Nova Scotia). Atlantic

Oceanographic Lab. For primary bibliographic entry see Field 5A. W76-06024

PLASTICS AND SYNTHETICS POINT SOURCE CATEGORY (PROPOSED EFFLUENT LIMITA-TIONS AND GUIDELINES).

Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G.

MICROBIOLOGICAL AND CHEMICAL EN-RICHMENT OF FRESHWATER-SURFACE MICROLAYERS RELATIVE TO THE BULK-SUBSURFACE WATER, Virginia Univ., Charlottesville. Dept. of Biology.

For primary bibliographic entry see Field 5C. W76-06124

EMORY OAK (QUERCUS EMORYI) LITTER PHENOLICS AS ENVIRONMENTAL HAZARDS FOR AQUATIC ANIMALS IN SOUTHEASTERN ARIZONA.

Colorado State Univ., Fort Collins. W. J. McConnell, and G. F. Adams. J Ariz Acad Sci. 8(3), p 111-115, 1973.

Descriptors: *Phenols, *Arizona, *Oak tree, *Litter, Aquatic animals, Organic compounds, Toxicity, Daphnia, Environmental effects,

Phenolic compounds (15) present in water extracts of litter of Emory oak (Q. emoryi) did not cause a discernable toxic response during 20-30 day expo-sures of 3 kinds of aquatic animals common in southeastern Arizona at 20 mg/l gallotannin equivalent. This concentration probably represents an unusually high, but occasionally attainable, natural concentration of total phenolics. A conifer phenolic flavonoid (taxifolin) closely similar to the oak phenolic quercetin depressed reproduction and/or survival of Daphnia pulex populations .-- Copyright 1974, Biological stracts. Inc. W76-06125

YEASTS ISOLATED FROM SOME LAKES AND RIVERS OF SASKATCHEWAN,

National Research Council of Canada, Saskatoon (Saskatchewan) Prairie Regional Lab. J. F. T. Spencer, P. A. J. Gorin, and N. R. Gardner. Can J Microbiol. 20(7), p 949-954, 1974.

Descriptors: *Canada, Lakes, Rivers, *Yeasts, Isolation, *Bacteria, Bioindicators, Water pollu-tion effects, Trees, Soils, Water pollution sources. Identifiers: *Saskatchewan River.

Yeasts were isolated from lakes in northern Saskatchewan, from the Saskatchewan River between Prince Albert and Cumberland House, and from 3 small lakes near Saskatoon, (Canada), 2 of which form part of recreational areas. Yeast and bacterial counts were relatively low, less than 400 yeast cells/liter, except in samples taken near towns and industrial plants which discharged waste into the rivers or lakes. There was little change in the numbers of yeast cells in waters used for recreational purposes only, but the number of species isolated increased considerably. Most of the yeasts isolated from the other lakes and rivers were species known to occur in association with trees and in soils .-- Copyright 1974, Biological Abstracts, Inc. W76-06135

MERCURY OCCURRENCE IN SEDIMENT

CORES FROM WESTERN LAKE ERIE, Bowling Green State Univ., Bowling Green, Ohio. Dept. of Geology. L. J. Walters, Jr., T. L. Kovacik, and C. E.

Herdendorf Ohio J Sci. 74(1) p 1-19, 1974.

Descriptors: *Mercury, *Lake Eric, *Lake sediments, *Pollutant identification, Water pollution sources, Mathematical models, Path of pollutants. Identifiers: Detroit River(Mich).

The Detroit River is the major source of Hg contamination in the sediments of western Lake Erie. Analyses of 63 sediment cores indicate that the Hg consists of 2 components: a high-concentration (0.5-4.0 ppm of dry sediment) Hg-enriched surface zone, whose concentration decreases pseudo-ex-

Group 5B-Sources Of Pollution

ponentially with depth, and low-concentration (0.04-0.09 ppm of dry sediment) relatively constant-background zone. Mathematical modeling of the Hg concentration as a function of depth in these sediment cores and subsequent statistical analysis of the apparent constant-concentration levels reveals that 2 log-normal distributions are necessary to describe these observed constant concentrations. Any Hg concentration within the sediment in excess of the lower (natural) background level plus 1 SD is defined as being due to pollution. Such calculations of the pollution component for these 63 cores serve as the basis for an estimate of the total Hg that has been added through pollution sources. The Hg-pollution load for bottom sediments of western Lake Erie is estimated to be 228 metric tons. --Copyright 1974, Biological Abstracts, Inc.

BEHAVIOUR OF SOME PHOSPHATIC FERTIL-IZERS IN WATER, Khatauli Manure Mills, Khatauli (India).

Khatauli Manure Mills, Khatauli (India). B. S. Gupta. J Indian Soc Soil Sci. 21(4), p 413-420, 1973.

Descriptors: *Fertilizers, *Phosphates, Carbon dioxide, Soils, Degradation(Decomposition), Decomposing organic matter, Water pollution

Identifiers: *Bone meal, Phosphatic rock, Slag.

The behavior of raw bone meal, steamed bone meal, calcined bone meal, rock phosphate, calcined rock phosphate and high grade basic slag in water at different conditions was studied. Water plays an important role in the decomposition of these phosphates; it remains active 50-60 days in the case of calcined rock, bone phosphates, basic slag and rock phosphate. In the case of raw and steamed bone meals, water is also responsible to form organic acids which increase the rate of decomposition and improve the phosphate status in aqueous solutions. CO2 decomposed these phosphatic materials; its efficiency was pronounced at low concentration. The relative solubility in CO2 and water followed the order: raw bone meal > steamed bone meal > calcined bone meal > high grade basic slag > calcined rock phosphate > rock phosphate. The suitability of these phosphatic fertilizers for different soil conditions is discussed.--Copyright 1974, Biological Abstracts, Inc.

STUDIES ON DEPTH AND QUALITY OF WATER ON SOIL SALINIZATION: BEHAVIOUR OF ANIONS IN THE SOIL PROFILE WITH REFERENCE TO THE POSITION OF WATER TABLE, Central Soil Salinity Research Inst., Karnal

Central Soil Salinity Research Inst., Karnal (India).

For primary bibliographic entry see Field 2G. W76-06141

THE COMBINED EFFECTS OF HIGH SALINI-TY AND TEMPERATURE ON THE SURVIVAL OF YOUNG LIMANDA LIMANDA, Leeds Univ. (England). Wellcome Marine Lab.

Leeds Univ. (England). Wellcome Marine Lab. For primary bibliographic entry see Field 5C. W76-06148

EVALUATION OF SURFACE WATER POLLU-TION AT SEVERAL POINTS IN RELATION TO ZONES OF SHELLFISH INDUSTRY IN ROAD-STEADS OF THE BREST REGION, (IN FRENCH), G. Martin-Bouyer, H. Veiga-Pires, G. Salama, J.

G. Martin-Bouyer, H. Veiga-Pires, G. Salama, J. P. Bechac, and F. Roger. Rev Int Oceanogr Med. 31/32 p 91-121, 1973.

Descriptors: *Bacteria, Coliforms, E. coli, *Bioindicators, Water pollution sources, Seasonal, Industrial wastes, *Organic wastes, Eu-

teric bacteria, Dissolved oxygen, Shellfish, Temperature. Identifiers: *France(Brest region).

Water samples (258) were studied, considering the following 10 parameters: coliforms, Escherichia coli, enterococci, temperature, pH, salinity, nitrites, organic matter, dissolved oxygen and BOD5 (biochemical oxygen demand). The levels of organic and bacteriological pollution were almost constant through the week. The tide had no influence on the pollution indicators, only on the salinity. Organic pollution depended on the location of the sampling stations. Fecal pollution followed almost the same pattern as organic pollution: Landerneau had the highest pollution level, Faou the lowest. Both organic and fecal pollution were strongly influenced by the seasons: the level organic pollution was always higher in JuneJuly; the 3 bacteriological tests indicated a variation of fecal pollution according to the seasons, but each test gave different results.—Copyright 1974, Biological Abstracts, Inc. W76-06150

5C. Effects Of Pollution

STUDIES ON THE EFFECTS OF COPPER ON THE LACTATE DEHYDROGENASE AND ESTERASE ISOZYMES IN VARIOUS TISSUES OF CARASSIUS CARASSIUS,

Dong kook Univ., Seoul (Republicof Korea). Dept. of Science Education.

Choon-Koo Lee, and Il-Young Choo. Korean J Zool. Vol 16, No 2, p 79-96. 1973. Illus.

Descriptors: *Copper, *Toxicity, Pathology. Identifiers: *Carassius-Carassius, Isozymes, Lactate dehydrogenase, LDH.

Histology and lactate dehydrogenase (LDH) isozyme patterns were studied by cellulose acetate electrophoresis, LDH activity and environmental Cu effect on LDH by spectro-photometry, esterase isozyme patterns by agar thin layer electrophoresis and Hb patterns by starch gel electrophoresis. Kidney, liver, gill, muscle, blood and brain tissue histopathology were studied.—Copyright 1975, Biological Abstracts, Inc. W76-05595

INTERACTIONS OF MERCURY WITH AQUATIC AND EDAPHIC ENVIRONMENTS, Kansas State Univ., Manhattan. Dept. of Agrono-

my.
For primary bibliographic entry see Field 5B.

EVALUATION OF THE TROPHIC TYPES OF SEVERAL ALASKAN LAKES BY ASSESSMENT OF THE BENTHIC FAUNA,

Alaska Univ., College. Inst. of Water Resources. J. D. LaPerriere.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 158, \$4.50 in paper copy, \$2.25 in microfiche. Report No. IWR-63, March 1975. 49 p, 9 fig, 9 tab, 27 ref, append. OWRT A-046-ALAS(1).

Descriptors: *Alaska, *Lakes, *Benthic fauna, Trophic level, *Oligotrophy, Invertebrates, Arctic, Subarctic, Diptera, Tubificids, Worms, Water pollution effects.

Selected morphometric, chemical, and physical parameters for six Alaska lakes are presented. Except for Big Lake, for which there is inadequate data, and Memory Lake, which is shallow, these lakes appear to be oligothrophic. Identification and enumeration data concerning the benthic macroinvertebrates are tabulated. The finding of chironomids indicative of oligotrophy is not conclusive evidence that a lake is oligotrophic, but may indicate only that it has been oligotrophic.

From evidence such as the high-standing crop of tubificid worms in certain areas of Harding Lake, as well as the high hydrophyte biomass, it is concluded that the trophic state system of lake classification may not be valid for the Alaskan subarctic and arctic.

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STATISTICAL STUDY OF THE DUCKWEED RHIZOSPHERE AS AN ECO-ASSAY TOOL, Massachusetts Univ., Waltham. Dept. of Environmental Sciences.

For primary bibliographic entry see Field 5B. W76-05605

EFFECTS OF FOREST FERTILIZATION ON TWO SOUTHEAST ALASKA STREAMS, Forest Service (USDA), Corvallis, Oreg. Pacific

Northwest Forest and Range Experiment Station.
W. R. Meehan, F. B. Lotspeich, and E. W.
Mueller.

Journal of Environmental Quality, Vol 4, No 1, p 50-55, 7 fig, 3 tab, 9 ref. Jan.-Mar. 1975.

Descriptors: *Water quality, Primary productivity, *Nitrogen, *Fertilization, Forest management, *Alaska, Ureas, Water pollution effects. Identifiers: Ammonia-nitrogen.

Four streams in southeast Alaska were studied to determine the effects of forest fertilization with urea on basic productivity and water quality. A initial, short-term increase in ammonia-nitrogen was observed in the treated streams, and nitratenitrogen levels increased and remained high compared to control stream levels during the year following treatment. Concentrations did not approach those considered toxic to aquatic life or unsafe for human consumption. Changes in biomass of periphyton and benthic fauna as a result of fertilization were not detected. (Forest Service) W76-05612

ESTIMATING DRY WEIGHT OF LIVE, UNANESTHETIZED FISH BY PHOTOGRAPHY, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5A. W76-0561.

THE APPLICATION OF SEQUENTIAL ESTI-MATION METHODS TO COUNTS OF PHYTOPLANKTON,

Comitato Nazionale per l'Energie Nucleare, Rome (Italy). Technological Lab. For primary bibliographic entry see Field 5A. W76-05622

MACROBENTHIC POPULATION DYNAMICS IN INDIANA WATERS OF LAKE MICHIGAN IN 1970.

Ball State Univ., Muncie, Ind.

I. H. Rains.

Available from the National Technical Information Service, Springfield, Va. 22161, as COM-75-10461 \$5.50 in paper copy, \$2.25 in microfiche. MS thesis, November 1971. 89 p. 18 fig, 14 tab, 84 ref.

Descriptors: *Benthic fauna, *Biological communities, *Dynamics, *Indiana, *Lake Michigan, Oligochaetes, Diptera, Water pollution, Eutrophication, Trophic level, Amphipods, Ecological distribution, Varieties, Fish food organisms, Midges. Identifiers: Sphaeriids, Pontoporeia affinis.

The distribution of the predominant macrobenthos in Indiana waters of Lake Michigan were studied and classified. The order of abundance of the major types of organisms collected was: the oligochaetes (64%); Pontoporeia affinis (21%), sphacriids (12%), and chironomids (3%). Oligochaetes averaged 4444/sq m. Based on oligochaete abundance, 21% of the samples col-

lected were from heavily polluted water, 42% in moderately polluted, and 37% in slightly polluted are P. affinis averaged 993/sq m and represented 21% of the macrobenthos, the sphaeriids 691/sq m and 12% of the population, sphaerius 69/1/sq m and 1/2% of the population, and the chironomids 242/sq m comprising 3% of the population. Eutrophic chironomid species were most abundant, accounting for 56% of the chironomid population. The Michigan City transect had the greatest abundance and highest percent composition of chironomids and sphaeriids. The Burns Ditch transect had the highest percent composition and abundance of oligochaetes. Th Gary transect had the greatest abundance and highest percent composition of P. affinis. A trophic classification using indicator chironomid species showed that the Michigan City transect was eutrophic; the Burns Ditch transect even more eutrophic; and the Gary transect mesotrophic. The Indiana waters of Lake Michigan were in the eutrophic range, with few exceptions. (Buchanan-Davidson--Wisconsin) W76-05623

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RELATIONSHIPS BETWEEN DRAINAGE AREA CHARACTERISTICS AND NON-POINT SOURCE NUTRIENTS IN STREAMS. Pacific Northwest Environmental Research Lab.,

Corvallis, Oreg. For primary bibliographic entry see Field 5B.

THE FATE OF NUTRIENTS IN BACK RIVER.

Johns Hopkins Univ., Baltimore, Md. J. F. Ferguson, and D. Simmons. Available from the National Technical Information Service, Springfield, Va 22161, as PB-241 004 \$4.00 in paper copy, \$2.25 in microfiche. Chesapeake Research Consortium, Inc. Publication No 32 (NSF-RA-E-74-035) June 1974. 30 p, 8 fig, 2 tab,

Descriptors: *Nutrients, *Cycling nutrients, Estuaries, Phosphorus compounds, Nitrogen compounds, Phytoplankton, Denitrification, Sediments, Model studies, Growth rates, Standing crops, Tidal effects, Nutrient removal, Waste water treatment, Effluents, Maryland. ldentifiers: *Back River(Maryland).

Fate of nutrients introduced into Back River by the Baltimore, Maryland, wastewater treatment plant was studied to provide basic information for evaluating the extent of nutrient transformations and loss. All fractions decreased rapidly along the estuary, with net conversion of orthophosphate to particulate phosphorus and of ammonia to particulate nitrogen, nitrite, and nitrate, indicating summer-fall phytoplankton growth and bacterial nitrification. Phosphate accumulated in sediments more than nitrogen. A finite section, one-dimensional, steady state model of the estuary was developed. It demonstrated that nitrogen is not conserved in the water column. Net nitrogen losses approached 50% of the influx, primarily from the treatment plant. Nutrient concentrations were so high that estuarine phytoplankton growth rates and standing crops were not limited. Nitrogen or phosphorus removal from waste discharges might not significantly reduce growth rates or standing crops because of nutrient release from sediments, poor tidal dispersion, and estuary flushing. The results delineate nutrient cycling in an estuary. Phytoplankton productivity, standing crop, oxygen demand, and dissolved oxygen dynamics should be determined in order to model effects of waste discharge on other water quality aspects. The results will help determine what nutrient removal strategy will be most beneficial. (Buchanan-Davidson-Wisconsin). W76-05625

REPORT ON WATER QUALITY AND WASTE-SOURCE INVESTIGATIONS, BIG SIOUX RIVER AND SELECTED TRIBUTARIES. National Field Investigations Center, Denver,

Available from the National Technical Inform tion Service, Springfield, Va, 22161, as PB-227 833, \$8.00 in paper copy, \$2.25 in microfiche. Report August 1973. 247 p. 15 fig., 11 tab., 4 ref., 11

Descriptors: *Rivers, *Water quality, *Water pol-lution sources, *Iowa, *Minnesota, *South Dakota, Treatment facilities, Sewage effluents, Farm wastes, Dissolved oxygen, River basins, Streams, Biochemical oxygen demand, Suspended solids, Nitrogen compounds, Disinfection, Water quality standards, Pollutants, Pollution abatement, Permits, Industrial wastes, Municipal wastes, Waste water treatment, Ammonia, Phosphorus, Eutrophication, Coliforms.

Identifiers: *Big Sioux River(S.D.-Iowa), *Sioux Falls(S.D.), Rock River(Minn.).

Water quality degradation of the Big Sioux River Basin in Iowa, Minnesota, and South Dakota is caused by urban, agricultural, and industrial pollution sources. Studies of dissolved oxygen and stream biota showed that the most severe pollution was downstream from Sioux Falls, South Dakota. Major pollution sources included industrial condenser water, process wastes, and wastewaters from the Sioux Falls Wastewater Treatment Plant. To protect the water quality of the Big Sioux River and its tributaries, it is recommended that a waste discharge permit issued to Sioux Falls restrict daily effluents to BOD - 10 mg/1; SS - 15 mg/1; and TKN - 2 mg/l, and to stipulate that continuous dis-infection restrict coliform density to 200/100 ml and no weekly average to exceed 400/100 ml. That Sioux Falls establish enforceable pretreatment Sioux Falls establish enforceable pretreatment standards for those pollutants not susceptible to treatment by the municipal system and that the pretreatment standards include adequate sewer charges for all industrial waste sources. That waste discharge permits issued to other municipalities discharging into the Big Sioux Rivershould require a minimum of secondary treatment. That Iowa and Minnesota initiate appropriate abatement actions; and that the existing water quality standards for South Dakota Iowa and quality standards for South Dakota, Iowa, and Minnesota be brought into (Buchanan-Davidson--Wisconsin). conformity. into W76-05626

EUTROPHIC GRADIENT IN SMITH MOUNTAIN LAKE, VIRGINIA,
Virginia Polytechnic Inst. and State Univ.,

Blacksburg. Dept. of Biology. E. F. Benfield, and A. C. Hendricks. Virginia Journal of Science, Vol. 26, No. 1, p. 20-26, 1975. 11 fig., 1 tab., 15 ref.

Descriptors: *Eutrophication, *Gradation, *Reservoirs, Virginia, Industrial wastes, Municipal wastes, Primary productivity, Chlorophyll, Light penetration, Dissolved oxygen, Seasonal, Thermal stratification, Trophic in the Welling of the Mountain Dam(Virginia), *Roanoke River(Virginia), Blackwater River(Virginia).

Smith Mountain Lake is a storage reservoir for the Smith Mountain-Leesville Pumped-Storage Hydroelectric Project which is located on the Roanoke and Blackwater Rivers near Roanoke, Virginia. The headwaters of the Roanoke River Arm of Smith Mountain Lake have become eutrophic because of the continuous introduction of municipal and industrial effluents into the Roanoke River as it goes through the Roanoke metropolitan area. The studies show that the Roanoke River Arm of Smith Mountain Lake differed from areas near the Smith Mountain Dam in primary production rates, chlorophyll-a concentration, water transparency, depth of light penetra-tion, and surface oxygen saturation. A gradient in

some of these areas was observed in the fall, spring, and summer. The Roanoke River Arm could probably be classified as eutrophic, probably due to high nutrient loading by municipal and industrial discharges and the morphometry of the basin and surrounding terrain. There was a demonstrable gradient from eutrophic to mesotrophic conditions from the lake headwaters toward the Soith Mostatio Dee mesouropnic conditions from the lake headwaters toward the Smith Mountain Dam. Tertiary sewage treatment facilities being built in Roanoke should relieve the nutrient loading of the lake. (Buchanan-Davidson--Wisconsin). W76-05627

SURVIVAL OF ESCHERICHIA CGLI IN STREAM WATER IN RELATION TO CARBON DIOXIDE AND PLANT PHOTOSYNTHESIS, Culture Centre of Algae, Protozoa, Cambridge

(England). F A Grav

Journal of Applied Bacteriology, Vol. 39, No. 1, p. 47-54, 1975. 3 fig., 12 ref.

Descriptors: *Bacteria, *E. coli, *Carbon dioxide, *Inhibition, Photosynthesis, Coliforms, Viability. Identifiers: Cambridge(England).

Survival of coliform bacteria, especially Escherichia coli, was studied in a chalk stream, Hobson's Brook, near Cambridge, England, and in the laboratory in relation to physical and biotic factors. Peak populations were usualy associated with rainfall during the previous twelve hours. Some cells appeared to survive for long periods. The surrounding area had been used to graze sheep, but recently the land has been used for raising cereal crops. E. coli incidence was investigated in other chalk streams, brackish pools on peat, seawater, and water from a mountain stream. During laboratory studies in liquid, E. coli showed waves of growth. The carbon source appeared to be atmospheric carbon dioxide: E. coli ceased to grow when air free of atmospheric carbon dioxide was passed over the culture. When grown in a suspension of bacteria-free algae Stichococcus bacillaris, E. coli growth decreased in cultures grown in the light compared to those grown in the dark. After cessation of photosynthesis, E. coli growth increased. Field observations suggested an inverse relationship between E. coli numbers and mass of photosynthesizing green plants; decrease in carbon dioxide in natural waters due to photosynthesis may cause reduction of coliforms (especially E. coli) which require carbon dioxide for growth. (Buchanan-Davidson--Wisconsin). W76-05628

EUTROPHICATION OF AN INLAND LAKE IN IRELAND IN ASSOCIATION WITH THE IN-TENSIFICATION OF PIG FARMING IN THE CATCHMENT AREAS,
Department of Agriculture and Fisheries, Dublin

(Ireland). Advisory Services and Livestock.

E. J. Keating, and V. A. Dodd.

Agriculture and Environment, Vol. 2, No. 1, p. 55-

64, 1975. 4 tab., 12 ref.

Descriptors: *Eutrophication, *Lakes, *Farm wastes, *Agriculture, Watersheds(Basins), Topog-raphy, Hydrology, Retention, Nutrients, Soil disposal fields, Fertilization, Runoff, Lake fisheries, Rates of application, Confinement pens, Hogs, Waste disposal.
Identifiers: *Ireland, *Lough Sheelin(Ireland).

Eutrophication of Lough Sheelin, Ireland, is tak-ing place due to intensive pig production in its watershed. Retention time of water in the lake is watershed. Retention time of water in the lake is about 0.5 years, thus nutrients carried into the lake in the winter are available to stimulate spring growth of algal blooms, especially Aphanizomenon. The 853 kg manure produced per pig production/place per annum relates to feed and water consumed. Studies of the nutrient content of the production of t and fertilizer value of pig manure show that the ef-fect when spread on land varies with weather, soil

Group 5C-Effects Of Pollution

permeability, slope, application rate, and evapotranspiration rate; therefore care must be taken when spreading manure. In the Sheelin area, the most suitable time for spreading manure is usually May 28-July 14. Nutrient reaction in the soil and lake are discussed. Nitrate and phosphorus levels in Lake Sheelin are increasing, causing dense algal blooms which are injurious to fish and reduce water transparency. A safe, effi-cient, and economical method of manure disposal is needed. Animal production research must foresee problems arising from application of its findings to farming practice; these must be studied in association with production, not as a salvage operation. (Buchanan-Davidson--Wisconsin).

CHEMISTRY OF MUD-WATER INTERFACE IN AN IMPOUNDMENT, Illinois State Water Survey, Urbana.

W-C. Wang. Water Resources Bulletin, Vol. 11, No. 4, p. 666-675, 1975. 7 fig., 21 ref.

Descriptors: *Mud-water interfaces, *Water chemistry, *Impoundments, Illinois, Model studies, Oxidation-reduction potential, Thermal stratification, Dissolved oxygen, Chemical stratification, Turnovers, Hydrogen ion concentration, Alkalinity, Silica, Manganese, Chemical reactions, Nitrogen compounds, Bottom Chlorine, Reservoirs. sediments.

Identifiers: *Lake Evergreen(Ill.).

A model of chemistry at the mud-water interface was developed from observations of Lake Evergreen, Illinois, during and after filling. Aging occurred early in the impoundment stage. Hydrologic and biological activities and reduction of the oxidation-reduction potential influenced interface chemistry. Temperature and dissolved oxygen profiles showed chemostratification until fall overturn when distribution was non-parallel; pH decreased with warm temperatures and abundant food. Maximum alkalinity, silica, manganese, am-monia, and nitrogen coincided with minimum pH. Silica was utilized by diatoms which was then precipitated, enriching the bottom. These changes occurred primarily in autumn. Nitrate and nitrite had summer maxima. Kjeldahl nitrogen had summer and autumn maxima. Dissolved oxygen deficiencies developed in spring, causing anoxic conditions until fall. During fall decomposition, pH dropped below 8.0, and alkalinity, silica, am-monia, and Kjeldahl nitrogen increased. All parameters except conservative elements at the interface showed qualitative changes. There was no quantitative evidence how the interface affected the lake ecosystem. Sum of volume of transitional zone/total volume multiplied by the 365 days interwater body on a yearly basis. About 6-7% of the water body is anoxic annually, which is important for regeneration and replenishment of chemicals from bottom to overlying water. (Buchanan-Davidson--Wisconsin). W76-05630

EFFECTS OF SALINITY ON NITRIFICATION

IN THE EAST RIVER, New York State Dept. of Health, Albany. Environmental Health Center.
M. Chen, E. Canelli, and G. W. Fuhs.
Journal Water Pollution Control Federation, Vol.

47, No. 10, p. 2474-2481, 1975. 3 fig., 3 tab., 25 ref.

Descriptors: *Estuaries. *Salt *Nitrification, *Nitrogen fixing bacteria, *Inhibition, Salinity, New York, Water chemistry, Sodium chloride.

Identifiers: *East River(NY), Hudson River(NY). Bacterial nitrification rates increased when sam-

ples were diluted with suitable media prepared with distilled water. Nitrification rates in samples from southern or central parts of the East River, New York, were higher than in samples near the sound where river water was mixed with oceanic water and Hudson River water, possible affecting water quality and/or the number of nitrifying bacteria. Isolated nitrifying bacteria were not halo-philic, indicating that local nitrifying flora are essentially terrestrial in origin. No attempt was made to estimate the numbers of nitrifying bacteria. However, significant numbers were present. Salinity does not appear to be the sole cause for inphosphate, and magnesium exceeded the minimum requirements. The rate of nitrification in a 1 + 9 dilution of East River water was not significantly changed by omitting the usual supplements of calcium, magnesium, phosphate, and iron. Because East River water did not lack essential nutrients (nitrogen, calcium, magnesium, phosphate, iron), it is concluded that nitrification rates in the river are controlled by sodium chloride and unknown inhibitory elements. Temperature and dissolved oxygen also play important roles. (Buchanan-Davidson--Wisconsin).

PHOSPHORUS, NITROGEN, AND T GROWTH OF ALGAE IN LAKE KINNERET, Kinneret Limnology Lab., Tiberias (Israel). C. Serruya, and T. Berman.

Journal of Phycology, Vol. 11, No. 2, p. 155-162, 1975. 5 fig., 1 tab., 34 ref.

Descriptors: *Cytological *Eutrophication, *Phosphorus compounds, *Nitrogen compounds, *Algae, Growth rates, Lakes, Limiting factors, Absorption, Carbon, Phytoplankton, Dinoflagellates, Chlorophyll,

Identifiers: *Lake Kinneret(Israel), Peridinium cinctum, Alkaline phosphates, Luxury uptake.

Annual and seasonal variations in algal intracellular chemical composition in Lake Kinneret, Israel, were studied to determine nutrient limitations. Intracellular carbon, nitrogen, phosphorus, and chlorophyll concentrations were determined. Fluc-tuations in carbon:phosphorus, carbon:nitrogen, chlorophyll concentrates and nitrogen were related to nutrient conditions which influence annual phytoplankton development especially Peridinium cinctum blooms. High intracellular phosphorus at the beginning the bloom indicate adequate phosphorus supply and luxury consumption for short periods. Later, Peridinium grew despite high carbon: phosphorus ratios. Phosphorus usually limited growth eventually, but the 1970 bloom ceased despite high intracellular phosphorus. These observations, together with evidence from nutrient addition, and specific alkaline phosphatase determinations indicated that during most of the bloom, Peridinium was not directly limited by phosphorus. Bloom decline is usually marked by high carbon:phosphorus ratios. Phosphorus shortage often contributes to bloom cessation and limits fall phytoplankton growth. From 1969-1973, perhaps due to a drop in salinity, there were lower biologically-bound phosphorus levels without corresponding decreases in carbon biomass. Reasons for annual Peridinium bloom decline is complex and varies each year. High water temperature and light intensities, lake current patterns, and phosphorus are involved. A dissolved organic nitrogen increase, possibly from dinoflagellate breakdown, may slow Peridinium growth. (Buchanan-Davidson-Wisconsin) W76-05633

AN ICHTHYOFAUNAL SURVEY AND DISCUS-SION OF FISH SPECIES DIVERSITY AS AN IN-DICATOR OF WATER QUALITY, CODORUS CREEK DRAIN PENNSYLVANIA, DRAINAGE, VORK COUNTY.

York Coll., Pa. For primary bibliographic entry see Field 5A. W76-05634 CHEMICALLY
EXCHANGE IN A EUTROP
GENERAL MODEL,
Geological ENHANCED C02 A EUTROPHIC LAKE: A

Observatory, Palisades, N.Y.

S. Emerson. Limnology and Oceanography, Vol. 20, No. 5, p. 743-753, 1975. 4 fig., 8 tab., 18 ref.

Descriptors: *Carbon dioxide, *Model studies, *Transfer, *Boundary process, *Lakes, Eutrophication, Diffusion, Kinetics, Air-water interfaces, Canada Identifiers: *Experimental Lakes Area(Ontario).

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Carbon dioxide exchange between the atmosphere and water is governed by diffusion kinetics and the interfacial boundary layer reaction. Study of Lake 227, Experimental Lakes Area, Ontario, showed carbon dioxide invasion rate could not be explained by assuming a simple diffusion process. To quantitate reaction effect on carbon dioxide gas exchange rate, empirical data were derived from a lake simulation experiment and whole lake carbon balance. The theoretical basis for the enhancement factor was studied and model developed to explain chemical enhanced gas exchange. This model indicated that carbon dioxide invasion of this lake was 5-10 times that predicted if there was no reaction. Model results conformed with laboratory carbon dioxide invasion experiments. Chemical enhancement was caused by strong carbon dioxide gradients in the epilimnion being depleted of car-bon dioxide by eutrophication. This factor increased with increased boundary layer thickness, but total flux decreased. Carbon dioxide gas exchange rate calculations, especially in eutrophic lakes, may have relatively large enhancement fac-tor. Due to the wide range of alkalinity, pH in natural waters, simplified enhancement factor derivations used for oceans are not always applicable. This generalized model can be applied to many chemical and physical situation. (Buchanan-Davidson--Wisconsin) W76-05635

ASSESSMENT OF A STRESSED MACROIN-VERTEBRATE COMMUNITY,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology. C. H. Hocutt.

Water Resources Bulletin, Vol. 11, No. 4, p. 820-835, 1975. 9 fig., 1 tab., 22 ref.

Descriptors: *Analytical techniques, *Benthic fauna, *Stress, *Biological communities, Virginia, Standing crops, Water pollution effects, Distribution, Niches, Bioindicators.

Identifiers: New River(Va.), Ordination method, Diversity index.

The benthic fauna community tolerance to stress is dependent on the receiving system and the na-ture and degree to which stress is applied. When stress causes a response, the number of organisms, taxa, or both will be affected. An ordination method is described which assesses the effects of stress on macroinvertebrate community in New River, Virginia, and compared to the diversity index method. In the ordination method, standing crop, determined from total specimen and taxa numbers collected, is used to indicate community health. The most health situation was when standing crops and niche partitioning were greatest. Data are summarized by collection date. Stations most stressed by industrial wastes were located near the thermal discharge and the effects related to thermal discharge. Ordination was sensitive to natural and man-made stresses caused by settleable solids. Seasonal trends in specimen and taxa numbers of bottom fauna were observed; the greatest abundance occurred in August. Diversity index results contrasted with the ordination result and no coherent interpretation was possible. Substations stressed by industrial loading were frequently projected as healthier than reference stations, therefore conclusions reached by diversity index were rejected. (Buchanan-Davidson--Wisconsin) W76-05636

DETERGENT PHOSPHATE BAN YIELDS LITTLE PHOSPHORUS REDUCTION, PART I, Purdue Univ., Lafayette, Ind. Dept. of Environmental Engineering.

J. E. Etzel, J. M. Bell, E. G. Lindermann, and C. J.

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Water and Sewage Works, Vol. 122, No. 1, p. 91-93, 1975. 5 fig., 4 tab., 11 ref.

Descriptors: *Detergents, *Analytical technique, *Phosphates, *Rivers, *Legislation, Indiana, Eutrophication, Chemical analysis, Phosphorus compounds, Nitrogen compounds. Identifiers: Wabash River(Ind.), White River(Ind.), Algal assay procedure, Legislative im-

A study was made during the summer of 1974, to see if the Indiana State legislative ban on detergent phosphates had succeeded in making phosphorus a growth-limiting nutrient and consequently reduc-ing eutrophication in the Wabash and White Rivers and their principal tributaries. Alternate biweekly and their principal tributaries. Alternate biweekly water samples were analyzed for ortho and total phosphorus, nitrate-nitrogen, ammonia nitrogen, total Kjeldahl nitrogen, copper, magnesium, iron, sodium, calcium, and pH. Algal bioassays were also performed; spiking tests were done with phosphorus, nitrogen, and minor elements with EDTA were done using Selenastrum capricornum as the test organism. Toxicity of water and tum as the test organism. Toxicity of water sam-ples was also determined. Filamentous algae were assayed for the presence of surplus phosphorus. The results indicated that the legislative ban on detergent phosphates failed to reduce the remaining stream phosphorus to levels low enough to be of any biological significance in reducing the potential for algal growth. Flocculation at sewage treat-ment plants can be used effectively to reduce discharge of nutrients. An ancillary report on this investigation follows. (Buchanan-Davidson--Wisconsin) W76-05637

A DESCRIPTION OF THE TROPHIC STATUS AND NUTRIENT LOADING FOR LAKE GEORGE, NEW YORK, Rensselaer Polytechnic Inst., Troy, N. Y. Fresh

J. J. Ferris, and N. L. Clesceri.

FWI Report 75-1, June 1975. 15 fig., 24 tab. EPA P.O. 04J1p01527

Descriptors: *Trophic level, *Lakes, New York, Geology, Human population, Vegetation, Computer models, Lake morphology, Energy budget, Limnology, Water balance, Light penetration, Phosphorus compounds, Silica, Nitrogen compound, Productivity, Benthos, Varieties, Water temperature, Solar radiation, Phytoplankton, Biomass, Aquatic plant, Invertebrates, Fish, Organic, matter, Zoolankton, Nantoplankton, ganic matter, Zooplankton, Nannoplankton, Cycling nutrients.

Identifiers: *Lake George(N.Y.), *Phosphorus load, CLEANX model, Nutrient budgets, Water

The geography, geology, vegetation, human population, water uses, sewage effluents, morphometry, hydrology, and limnology of Lake George, New York, are reviewed. Geologic history is the primary element determining the lake's present trophic status. Precipitation is the only form of hydrologic import. The basin is a head-water for the Lake Champlain catchment area. Phosphorus exports are characteristic of oligotrophic soils. The small basin: emphasizes the importance of precipitation on lake surfaces a source of phosphorus and nitrogen loadings. No untreated sewage sources are known. Phosphorus loading estimates indicated that the lake is oligotrophic. The model CLEANX,

describing the pelagic epilimnetic zone, was correct in using the loading approach to determine productivity. High spring nutrient loadings and winter thaws, plus rising temperature and solar radiation levels, cause increased phytoplankton radiation levels, cause increased phytopiankton biomass. Dissolved nutrients increase due to decomposer activity on runoff organic matter. Zooplankton followed by non-piscivores cropping reduces pressure on phytoplankton, but with lower summer nutrient concentrations, nannoplankton become dominant. Biomass and phytoplankton increase in August-September, preceding lake turnover. Comparison of biomass with model simulations indicated that modeling evolutions indicated that modeling ecologic processes is sound and nutrient inputs from streams with subsequent internal recycling are the principal non-physical driving forces in the ecosystem. (Buchanan-Davidson--Wisconsin) W76-05638

ALGAL NITROGEN FIXATION IN CALIFORNI-

ALGAL NITROGEN FIXATION IN CALIFORNI-AN STREAMS: SEASONAL CYCLES, California Univ. Berkeley; and Clear Lake Algal Research Unit, Lakeport, Calif. A. J. Horne, and C. J. W. Carmiggelt. Freshwater Biology, Vol. 5, No. 5, p. 461-470, 1975. 5 fig., 2 tab., 23 ref.

Descriptors: *Algae, *Nitrogen fraction, *Streams, California, Seasonal, Cycles, Nostoc, Distribution, Growth rates, Nutrients, Water quality, Limiting factors.
Identifiers: *Rocky Creek(Calif.)

Nitrogen-fixation by Nostoc in Rocky Creek, California was measured. Since 1970, nitrogen-fixation has varied seasonally and spatially; it was highest during early stages of colony growth in shallow, clear areas with little shade. The annual shanow, clear areas with interstance. The annual nitrogen-fixation rate was similar to the Arctic tundra, larger than for Antarctic rivulets, and less than for temperate rocky shores. A heterocystous Nostoc was the only organism responsible for this fixation. Nostoc occurred in gelatinous clumps of varying size on stable boulders where Ulothrix zonata also grew. Nitrogenase activity occurred as soon as Nostoc was present; in shaded areas activity was seasonally irregular and low. Nostoc was found throughout Rocky Creek and most ad-jacent stream but not in the main river, Eel River South Fork. A significant but small contribution to the nitrogen income of the nitrogen deficient Eel River system was due to nitrogen-fixation. Nostoc establishment appeared to be controlled by reduced turbulence, firm attachment to substrate Nostoc colony disappearance in June was probably due to nutrient depletion. Opening the vegetation cover and admitting more light would encourage Nostoc growth but would reduce the high water quality in the Eel River system. (Buchanan-Davidson-Wisconsin) W76-05639

PRODUCTIVITY AND BIOCHEMICAL COM-POSITION OF CHLORELLA AT DIFFERENT LEVELS OF ILLUMINATION AND NITROGEN

LIMITATION, Akademiya Nauk SSSR, Novosibirsk. Institut

V. N. Belvanin, E. K. Volkova, I. N. Trubachev, and I. M. Pan'kova.

Soviet Plant Physiology, Vol. 22, No. 1, p. 41-46, 1975. 4 fig., 1 tab., 20 ref. Trans. of Fiziologiya Rastenii, Vol 22, No. 1, 1974.

Descriptors: *Cytological studies, *Productivity, *Biochemistry, *Chlorella, *Limiting factors, Light intensity, Nitrogen, Growth rates, Biomass, Algae, Cultures, Inhibition, Carbohydrates, Proteins, Metabolism, Chlorophyll, Photosynthes-

The effects of illumination on productivity, growth, and biochemical composition of dense cultures of Chlorella vulgaris during nitrogen

limited cultures are described. Maximal biomass increase was the same at all illumination levels. Decrease in algal productivity, high illumination began when nitrogen was added. Protein synthesis was determined by available nitrogen supply. Decrease the amount of protein synthesized by cells was accompanied by decreased cell size. Prolonged cultivation under condition of nitrogen deficit showed periodic fluctuations in cell direct. deficit showed periodic fluctuations in cell dimensions. The less nitrogen in the culture the greater the carbohydrate and protein content of the pethe carbohydrate and protein content of the pericellular medium, due to more intensive cellular secretion and less intensive removal of metabolites. Lipids, volatile acids, and traces of pyroracemic acid were also present; free fatty acids, sterols, carotene, and chlorophyll were present in lipids. These changes in the medium caused changes accompanying microflora. Chlorella viability declined in conditions of nitrogen deficit. Nitrogen metabolism play a determining role in chlorophyll synthesis photosynthetic apparatus formation, and chlorella multiplication. High illumination intensify inhibited photosynthesis and carbohydrate synthesis in cells within a wide range of nitrogen supply. in cells within a wide range of nitrogen supply. Nitrogen deficiency caused active photosynthesis in algae and therefore partially compensated for the decreased photosynthesis caused by illumina-tion. (Buchanan-Davidson--Wisconsin)

FECUNDITY OF THE BROWN BULLHEAD, IC-TALURUS NEBULOSUS (LE SUEUR) IN A MINE ACID POLLUTED RIVER. West Virginia Univ., Morgantown.

For primary bibliographic entry see Field 8I. W76-05641

ACCUMULATION AND ELIMINATION OF DIELDRIN BY CHANNEL CATFISH (ICTALURUS PUNCTATUS),

Iowa Cooperative Fishery Unit, Ames. L. R. Shannon.

Available from the National Technical Informa-tion Service, Springfield, Va. 22161 \$5.00 in paper copy, \$2.25 in microfiche. PhD thesis, 1974. 87 p. 13 fig, 5 tab, 55 ref, 8 append. OWRT A-042-IA(3).

Descriptors: *Pesticide residues, *Dieldrin, *Fish, Fish diets, Channel catfish, Absorption, Exuda-tion, Pesticide kinetics, Water, Size, Chlorinated hydrocarbon pesticides. Identifiers: Excretion.

Dieldrin accumulation and elimination by channel catfish after exposure to dieldrin in water and food were studied in the laboratory. When 4-14 inch cat-fish were immersed 6 hours in a solution contain-ing 18.8 ppb dieldrin, the highest uptake was in the dorsal muscle of 7-10 inch fish. Dieldrin elimina-tion was slowest in 12-14 inch fish. When 6-9 and 14-16 inch fish were exposed to 75 ppt dieldrin for 28 days, larger catfish accumulated more dieldrin than smaller fish. After elimination for 28 days, dieldrin levels in both groups were about equal. Balance between uptake and excretion occurred in 56 days in muscles of 6 inch catfish exposed to 13 ppt dieldrin, and muscle exposed to 27 ppt were approaching balance. Catfish exposed to 2 ppm dieldrin in their diet accumulated more dieldrin than fish exposed to 75 ppt in water. When fish were exposed to dieldrin in both food and water, both sources contributed to the total load. Large catfish accumulated more dieldrin from food and water than smaller catfish. After elimination for 28 days, dieldrin levels were not significantly dif-ferent in muscles of 6-9 inch and 14-16 inch catfish exposed to dieldrin in both food and water. (Buchanan-Davidson-Wisconsin). W76-05642

ANTIMYCIN: BEYOND TELEOCIDE, Wisconsin Univ., Madison. Mary Ellen Antonioni. Trans Wis Acad Sci Arts Lett. 62 p 285-301. 1974.

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION Group 5C-Effects Of Pollution

Descriptors: *Antimycin A, *Toxicity, *Clams,

Temperature. Identifiers: Elliptio Dilatatus, Fluorescein, Lampsilis Siliquoidea, Teleocide.

Two species of clams, Lampsilis siliquoidea and Elliptio dilatatus, were exposed to each of 4 dosage levels of antimycin (5, 10, 12, and 15 ppb antimycin/water) at 3 temperatures (17C, 22C, and 27C). Each temperature test constituted a 'run' of 27 days, during which the organisms were observed and dieoff recorded. The pH was a constant 7.5 and general water quality constant. At run 3 (27C), fluorescein dye (used as a tracer dye with antimycin) was also tested alone and in combination with 15 ppb antimycin. For both species, increase in dieoff as temperature increased was significant for 12 ppb and 15 ppb, but not for 5 or 10 ppb. There was an overall significant increase in dieoff as temperature increased. A comparison among 15 ppb antimycin, 15 ppb antimycin plus fluorescein; and fluorescein alone, vielded the following results: there was no significant difference in dieoff between the 15 ppb antimycin and 15 ppb antimycin plus fluorescein; there was no dieoff for fluorescein dye alone. The increase in dieoff with increasing temperature was significantly greater for L. siliquoidea than for E. dilatatus for dosages 5 and 10 ppb. The total number of dead individuals after 27 days was significantly greater for L. siliquoidea than for E. dilatatus at 22C and 27C, but not at 17C. -- Copyright 1975., Biological Abstracts Inc.

DEVELOPMENT OF OXYGEN DEFICITS IN 14 SOUTHERN ONTARIO LAKES,

Trent Univ., Peterborough (Ontario). Dept. of Biology. D. C. Lasenby.

Limnology and Oceanography, Vol. 20, No. 6, p 993-999, November 1975. 1 fig, 3 tab, 24 ref.

Descriptors: *Hypolimnion, *Oxygen demand, *Canada, *Secchi disks, *Seston, *Lakes, *Sediments, Summer, Respiration, Temperature, Areal, Productivity, Epilimnion, *Water pollution effects, Mesotrophy, Oligotrophy. Identifiers: *Ontario(Canada).

Areal hypolimnetic oxygen deficits in 14 southern Ontario lakes developed linearly throughout summer in 13 of the lakes and decreased, usually linearly, as the upper limit of the hypolimnion was chosen at successively greater depths. The effect of this decrease on the calculated deficit was not great. Areal hypolimnetic oxygen deficit ranged from 0.006 to 0.041 mg/sq cm/day; it was not cor-related with average dry weight of seston in summer but was correlated with average Secchi depth during summer. This range suggested that the 14 Ontario lakes can be classified as either mesotrophic or oligotrophic using Mortimer's limits. (Lardner-ISWS) W76-05679

SENSITIVITY OF BLOOD CELL COUNTS IN соно (ONCORHYNCHUS KISUTCH) TO STRESSORS INCLUDING SUBLETHAL CONCENTRATIONS OF PULP MILL EFFLUENT AND ZINC,

B. C. Research, Ltd., Vancouver.

D. J. McLeay.

Journal of the Fisheries Research Board of Canada, Vol. 32, No. 12, p 2357-2364, Dec., 1975. 32 ref. 5 tab.

Descriptors: *Pulp wastes, *Zinc, *Water pollution effects, *Salmon, Wastes, Industrial wastes, Fish, Aquatic animals, Aquatic life, Water pollution sources, Toxicity.

Identifiers: *Coho salmon, Blood cells, White blood cells, White blood cells, Red blood cells, Sublethal effects.

Transfer of fish from optimal to high-temperature crowded holding conditions decreased white blood cell-thrombocyte (WBC-T) counts markedly on 12-96 hr exposure. Red blood cell (RBC) counts vere increased only slightly at 12 and 48 hr. During 28 days acclimatization following transfer to simulated stream compartments, WBC-T counts returned to stock values within 2-4 days, following an initial decline. RBC counts were not altered appreciably. The decline in WBC-T counts ofacclimatized fish to a high sublethal concentration of bleached kraft pulp mill effluent was greatest at 24 hr. Mean RBC counts were decreased over 24-96 hr, but differences were significant at 24 hr only. In acclimatized fish exposed to pulp mill effluent, WBC-T counts were decreased at concentrations between 0.2 and 0.9 of the 96 hr LC(50). A 24 hr exposure to 15% voll of this effleutnt had considerably less effect on the WBC-T count whenef-fluent had been detoxified by foam fractionto. Under similar experimental conditions, exposure to sublethal lvels of zinc depressed mean WBC-T counts proportional to concentration, although difwere only significnt at 0.5 LC(50) greater. RBC counts were unchanged. The WBC-T response provids a reasonably rapid and sensitive method for measuring stressful levels of pulp mill effluents to salmon. Declines in WBC-T counts are attributable to reduced numbers of circulating small lymphocytes, which could result in decreased resistance of stressed fishes to disease. W76-05696

EFFECT OF BLEACHED KRAFT MILL EF-FLUENT ON THE SURVIVAL OF STARVED JU-VENILE COHO SALMON (ONCORHYNCHUS KISUTCH),

KISUTCH),
B. C. Research Ltd., Vancouver.
D. A. Brown, and D. J. McLeay.
Journal of the Fisheries Research Board of
Canada, Vol. 32, No. 12, p 2528-2530, Dec., 1975. 4

Descriptors: *Pulp wastes, *Bleaching wastes, *Water pollution effects, *Fishkill, Wastes, Industrial wastes, Water pollution sources, Fish, Water pollution, Toxicity.

*Coho salmon, Sublethal effects,

Starved coho salmon fingerlings were exposed to sublethal concentrations of neutralized bleached kraft mill effluent. The time to death was similar in the control group, in fish continuously exposed to effluent concentrations equivalent to 0.05-0.4 of the samples' 96-hr LC(50) values, and in fish exposed to a treated (foam-stripped) portion of the samples at a volume equivalent to 0.7 LC(50) for untreated effluent. Time to death decreased progressively in groups exposed to effluent con-centrations higher than 0.4 of the 96-hr LC(50). (Witt-IPC) W76-05710

COMPARATIVE TOXICITY OF POLYELEC-TO SELECTED AQUATIC ANIMALS.

National Water Quality Lab., Duluth, Minn; and Environmental Research Lab., Duluth, Minn. K. E. Biesinger, A. E. Lemke, W. E. Smith, and R.

Journal of the Water Pollution Control Federation. Vol. 48, No. 1, p. 183-187, January 1976. 4 tab, 9

Descriptors: *Polyelectrolytes, Rainbow trout, "Lake trout, Laboratory tests, *Lethal limit, "Toxicity, "Bioassay, Reproduc-tion, Water quality control, Water pollution sources, Water pollution effects, Chemicals, Suspended solids, Methodology, Environmental effects, Aquatic animals.

Identifiers: Salvelinus namaycush, Sublethal effects, Mysis relicta, Limnocalanus macrurus, Median tolerance limits, Superfloc, Magnifloc,

The toxicity of selected polyelectrolytes to rainbow trout (Salmo gairdneri), lake trout (Salvelinus namaycush), Mysis relicta, Daphnia magna and a copepod (Limnocalanus macrurus) was determined. The median tolerance limits in milligrams per liter ranged from less than 0.06(Mysis) to 2.90 (lake trout) for Superfloc 330, from 0.65 (Daphnia) to greater than 8.0 (lake trout) for Calgon M-500, from less than 6.20 (Daphnia) to 218 (rainbow trout) for Gendriv 162, from 2.10 (Daphnia) to 8.70 (Cainbow trout) for Magniflos 521C, and from 16.5 (Daphnia) to greater than 8.0 (rainbow trout) for Magniflos 595N. The TL-50's for Daphnia were 1.85 for Magniflos 570C and 17.0 for Dow AP-30. Superfloc 330 and Calgon M-500 impaired reproduction of Daphnia at low levels of concentration. (Katz) W76-05740

EFFECT OF ENVIRONMENTAL FACTORS ON STANDING CROP OF PLANKTON IN BRITISH COLUMBIA LAKES.

M. S. Topping.

Verhandlungen International Verein Limnologie, Vol. 19, p. 524-529, October 1975. 3 fig., 2 tab., 10

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Descriptors: *Primary productivity, *Food chains, *Biomass. *Dissolved solids. *Lakes. *Nutrients. *Standing crops, *Productivity, *Temperature, Crop production, Trophic level, Seasonal, Statistical models, Solutes, Aquatic populations, Biological communities, *Canada. Identifiers: TDS, British Columbia.

Concentration of total dissolved solids (TDS) is used as a simple measurement of nutrient supply and has been considered as an indicator of lake productivity. Settled volumes of total quantitative plankton samples collected during spring and late summer from 27 fresh and alkaline lakes (17-29,987ppm TDS) were studied to define the effect of a widerange of TDS values on standing crop, to evaluate the relative importance of TDS versus energy related and other environmental variables and to investigate the role of TDS as a determinant of plankton productivity. Maximum standing crop occurred at about 8,200ppm TDS during spring and about 70ppm TDS during late summer. At lower concentrations TDS may indicate nutrient concentration while at higher concentrations those same solutes may become osmotically limiting, dependent on temperature. TDS and energy related variables appear to be equally important in ac-counting for differences in standing crop throughout British Columbia. Differences in seasonal standing crop were a negative curvilinear function of TDS. (Katz) W76-05741

ACUTE TOXICITY OF A NATIVE MUM-MICHOG POPULATION (FUNDULUS (FUNDULUS HETEROCLITUS) TO MERCURY, Montclair State Coll., Upper Montclair, N.J. Dept.

of Biology J. Klaunig, S. Koepp, and M. McCormick.

Bulletin of Environmental Contamination and Toxicology, Vol. 14, No. 5, p. 534-536, 1975. 1 fig.,

Descriptors: *Mercury, *Lethal limit, *Toxicity, *Estuaries, *Toxicants, *Heavy metals, Water pollution sources, Water pollution effects, Estuarine fisheries, Fish, *Fish behavior, Laboratory tests, Metals, Public health, Estuaries, Teleosts, Methodology.
Identifiers: Sublethal effects, Fundulus heteroclitus, *Mummichog, Tolerance limits.

dose-response of native mummichog (Fundulus heteroclitus) populations to mercury was determined using specimens obtained from Sandy Hook Bay, New Jersey. Test groups of 20 healthy fish each were incubated for 96 hours in one of 11 different dosages of mercuric chloride ranging from 0.23-4.6 mg/liter. Fish showed no visible response to the toxicant in dosages up to 0.86 mg/liter. Sluggish behavior developed in fish surviving exposure levels above 1.15 mg/liter. Fish exposed to intermediate levels (1.15-2.0 mg/liter) developed uncoordinated swimming movements. Fish exposed to maximal levels of the toxicant showed a marked increase in the opercular rate, reflecting respiratory stress. Death occurred within 24 hours of the initial exposure. (Katz) W76-05742

THE EFFECT OF OXIDIZED MATERIAL ON THE VERTICAL DISTRIBUTION OF FRESH-WATER BENTHIC FAUNA, State Univ. Coll., at Brockport, N.Y. Dept. of

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W. B. Kirchner.

Freshwater Biology, Vol. 5, p. 423-429, 1975. 1 fig., 4 tab., 10 ref.

Descriptors: *Benthic fauna, *Oligochaetes, *Nematodes, *Diptera, *Distribution patterns, *Benthos, Environmental gradient, Sediments, Oxidation, Methodology, Sampling, Water pollution effects.

Identifiers: *Vertical distribution, Oxidized layer,

Reduced laver.

The vertical distribution of representatives of the benthic groups: Ostracoda, Nematoda, benthic groups: Ostracoda, Nematoda, Oligochaeta, Harpacticoida, Cyclopoida and Chironomidae was determined. All groups had their highest numbers and biomass in the first 2 cm. The downward extent of oxidized material affected the distribution by dispersing the biomass more, as seen by the deeper occurrence of groups when the oxidized material increased. Both the nematodes and oligochaetes were found to inhabit the first reduced layer when the oxidized material was less than normal. (Katz) W76-05743

SOME OF THE EFFECTS OF DOMESTIC SEWAGE DISCHARGE INTO HICKMAN AND JESSAMINE CREEKS IN JESSAMINE COUN-TY, KENTUCKY,

Asbury Coll., Wilmore, Ky. For primary bibliographic entry see Field 5B. W76-05841

SECOND ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF METALS IN AQUATIC ENVIRONMENTS, Environmental Research Lab., Narragansett, R.I.

R. Eisler, and M. Wapner.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-248 211, S11.00 in paper copy, \$2.25 in microfiche. Report EPA-600/3-75-008, October 1975, 399 p. EPA 1BA022;ROAP/Task No. 16 AAT/31.

Descriptors: Fishes, Cations, Salinity, *Metals, Aquatic animals, Water pollution, *Toxicity, Metabolism, *Bibliographies, Radioisotopes, Invertebrates, Heavy metals, Trace elements, *Water pollution effects, *Aquatic environment. Identifiers: Aquatic vertebrates, Trace metals, Elements, experiitions. Elemental composition.

A total of 725 references are listed on the toxicological, physiological, and metabolic influence of stable and radiolabelled chemical species of metal cations to marine, estuarine, and freshwater fauna and flora. References were annotated and subsequently indexed by metal, by taxa, and by author, in cumulative indices which encompass this volume and the initial volume in this series (Eisler, R. 1973. Annotated bibliography on biological effects of metals in aquatic environments (No 1-567). U.S. Envir. Prot. Agen. Rept. R3-73-007: 287 pp). (EPA) W76-05863

ENVIRONMENTAL RESPONSES TO THER-MAL DISCHARGES FROM MARSHALL STEAM STATION, LAKE NORMAN, NORTH CAROLINA

CARULINA,
Johns Hopkins Univ., Baltimore, Md. Dept of
Geography and Environmental Engineering.
L. D. Jensen.

L. D. Jensen. Available from NTIS, Springfield, Va., 22161, as PB-237 662, \$8.00 in paper copy, \$2.25 in microfiche. April 1974, 250 p, 142 fig, 92 tab, 153 ref, 4 append.

Descriptors: *Thermal pollution, *Environmental effects, *Aquatic environment, *Water quality, Productivity, Algae, Plankton, Fish, Benthos, Oxygen, Nitrogen, Nitrates, Cooling water, Animal diseases, Fungi, Water pollution effects, Seasonal, *North Carolina. Identifiers: *Marshall Steam Station(NC), *Lake

Norman(NC).

Physical and meteorological data on thermally stratified Lake Norman, North Carolina, were gathered and used in studies of the effects of water quality changes caused by the action of the Marshall Steam Station condenser cooling system on the lake's organic productivity, and plankton, benthic, and fish populations. Thermal effects of the heated water were insignificant overall but sig-nificant in the discharge area. Stimulation of algal growth by the effluent appeared to be prevented by limitations in solar penetration. Plankton popu-lations showed strong seasonal variations, making it difficult to ascribe these changes to the action of the steam station. The number and diversity of benthic species collected in the effluent of the discharge station were lower than at the control stations. (See W76-05871 thru W76-05878) (Chilton-ORNL) W76-05870

INTRODUCTION AND PHYSICAL DESCRIP-TION OF LAKE NORMAN, Johns Hopkins Univ. Baltimore, Md. Dept. of Geography and Environmental Engineering. L. D. Jensen, D. K. Brady, and R. F. Gray. In: Environmental Responses to Thermal Discharges from Marshall Steam Station, Lake Norman, North Carolina. p 1-6, April 1974 5 fig, 1

Descriptors: *Lakes, *Reservoirs, Limnology, Freshwater, Powerplants, Dams, North Carolina. Identifiers: *Lake Norman(NC), Marshall Steam Station(NC), Physical description

Lake Norman was formed in 1963 by the construction of a dam on the Catawba River in North Carolina. The lake has a shoreline of about 840 km and a surface area of 131 sq. km. Its total drainage area of approximately 4660 sq. km. yields a mean annual flow of about 75.5 cubic m/sec. Full pond surface elevation is 232 m above mean sea level. The mean depth at full pond is 10.3 m and the total volume of water stored is about 1.35 x 10 to the 9th power cubic meters. Average detention at the mean river flow rate is 207 days. Annual fluctuations in lake surface elevation range over approxi-mately 3.6 m. Marshall Steam Station is located on the west shore of Lake Norman at the head of an extended cove. Cooling water is pumped through the plant's condensers and discharged at the head of a nearby downstream cove. The discharge point is about 1.5 km from the section where the cove adjoins the main longitudinal axis of the lake. Nineteen sampling stations are located in a seg-ment of the lake which covers some 32 km between the upstream and downstream stations. (See also W76-05870) (Chilton-ORNL) W76-05871

THERMAL AND WATER QUALITY CHARAC-TERISTICS OF LAKE NORMAN, Johns Hopkins Univ., Baltimore, Md., Dept. of Geography and Environmental Engineering. L. D. Jensen, D. K. Brady, R. F. Gray, W. D. Adair, and J. J. Hains.

In: Environmental Responses to Thermal Discharges from Marshall Steam Station, Lake Norman, North Carolina. p 7-119, April 1974, 54 fig. 48 tab.

Descriptors: *Limnology, *Thermal stratification, *Water quality, *Environmental effects, Aquatic life, Hypolimnion, Epilimnion, Oxygen, Nitrogen, Seasonal, North Carolina. Identifiers: *Lake Norman(NC), Marshall Steam Station(NC).

A significant feature of the Marshall Steam Station interactions with Lake Norman is the skimmer wall used to withdraw hypolimmetic water during the stratified period (late April through October) of the year. Aquatic organisms are influenced by of the year. Aquate organisms are influenced on natural changes in thermal stratification and con-current water quality influences, such as low dis-solved-oxygen levels within the hypolimnetic layer, and by man-made changes in this stratificalayer, and by man-made changes in this stratifica-tion sequence. Since the cooling water originates in the hypolimnetic layer during the stratified period of the year, the combined thermal discharges are approximately equivalent to tem-peratures occurring as a result of daily and seasonal warming in the epilimnetic layers. Con-siderable dilution of the thermal effluent occurs in the mixing area and downlake with the result that water temperatures do not appear to be more than a few degrees above ambient upper layer tempera-tures. Dissolved oxygen levels in the discharge area and downlake mixing area appear to be influenced by the hypolimnetic water supply during the stratified period. Oxygen levels in the discharge area appear to be biologically limiting during these periods. During winter, the thermal elevations appear to result in increases of nitrogen saturation values in the thermal discharges. (See also W76 - 05870) (Chilton-ORNL) W76-05872

PLANKTON POPULATIONS, Johns Hopkins Univ., Baltimore, Md., Dept. of Geography and Environmental Engineering.
E. F. Menhinick, and L. D. Jensen.
In: Environmental Responses to Thermal

Discharges from Marshall Steam Station, Lake Norman, North Carolina. p 120-138, April 1974, 14 fig, 1 tab.

Descriptors: *Limnology, *Thermal stratification, *Aquatic populations, *Environmental effects, Powerplants, Hypolimnion, Epilimnion, Phytoplankton, Zooplankton, Seasonal, North Carolina, *Distribution patterns. Identifiers: *Lake Norman(NC), *Marshall Steam Station(NC).

Phytoplankton and zooplankton populations showed strong seasonal patterns of distribution during both the stratified (summer) and unstratified (winter) condition of the lake. The individual plankters had a relatively patchy distribution and were generally confined to the upper layers. The use of a skimmer wall at the steam station to retain these warm surface waters during stratified periods produced relatively different plankton populations between the intake cove and the rest of the lake. During the period when the lake was relatively isothermal, fewer differences between the intake cove and the rest of the lake populations were observed. Within the mixing area populations were observed. Within the mixing area downlake, plankton populations were essentially similar to those uptake from the intake cove, and thus effects of the power plant were confined to the intake cove area. (See also W76-05870) (Chilton-ORNL) W76-05873

PRIMARY PRODUCTION,
Johns Hopkins Univ., Baltimore, Md. Dept. of
Geography and Environmental Engineering.
R. A. Smith, A. S. Brooks, and L. D. Jensen.
In: Environmental Responses to Thermal
Discharges from Marshall Steam Station, Lake

Group 5C-Effects Of Pollution

Norman, North Carolina. p 139-147, April 1974, 8 fig, 3 tab.

Descriptors: *Limnology, *Environmental effects, *Thermal pollution, *Primary productivity, *Photosynthesis, Aquatic populations, Seasonal, Light penetration, North Carolina, Powerplants. Identifiers: *Entrainment(Plankton), *Marshall Steam Station(NC), Lake Norman(NC).

Pump entrainment studies were conducted to determine changes in the rate of uptake of C 14 in phytoplankton populations occurring as a result of passage through the Marshall Steam Station cooling water condenser system. Comparisons of photosynthetic rates of intake samples incubated at intake temperatures with intake samples incubated at discharge temperatures suggested that there is little evidence of any loss of primary production capacity of either entrained or plume-entrained phytoplankton populations due to the operation of Marshall Steam Station. The data show photosynthetic rate changes varying from large increases in cooler months, to much smaller increases in warmer months. In contrast to results of similar studies at other power plants, the rates continued to be stimulated slightly at elevated temperatures even when Lake Norman temperatures reached the summer maximum. Limitations in light penetration appeared to effectively prevent the stimulations of algal populations in the downlake area from increasing to densities that would produce nuisance conditions. (See also W76-05870) (Chilton-ORNL) W76-05874

THE EFFECT OF THERMAL DISCHARGE ON THE RATE OF ACCUMULATION OF ORGANIC SUBSTANCES ON GLASS SURFACES IMMERSED IN LAKE NORMAN,

Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering. C. M. Weiss.

In: Environmental Responses to Thermal Discharges from Marshall Steam Station, Lake Norman, North Carolina. p 148-161, April 1974, 12 fig, 3 tab.

Descriptors: *Thermal pollution, *Environmental effects, *Organic matter, *Productivity, Sampling stations, Depth, Light penetration, Temperature, Seasonal, Limnology, North Carolina. Identifiers: Marshall Steam Station(NC), *Lake Norman(NC).

Glass slides were hung at various depths at four representative stations in Lake Norman over a period of five years to evaluate the effects of thermal discharges from Marshall Steam Station on the accumulation of organic materials. Sampling stations were located on each side of the skimmer wall, at the mouth of the discharge cove, and downlake. Over the five-year period of exposure, seasonal changes in the rate of organic productivity were indicated but were most pronounced in the surface samples and decreased with depth. Net changes in water temperatures at the four stations and at four depths were noted in the comparison of the year-to-year record of organic accumulation averaged in two-month sequences. Increases in the rate of organic production appeared to be more related to depth (suggesting difference in light penetration) than to temperature. (See also W76-05870) (Chilton-ORNL) W76-05875

ZOOPLANKTON ENTRAINMENT,

Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering. R. M. Davies, and L. D. Jensen.

In: Environmental Responses to Thermal Discharges from Marshall Steam Station, Lake Norman, North Carolina. p 162-172, April 1974. 16 fig. 6 tab. Descriptors: *Environmental effects, *Thermal pollution, *Zooplankton, *Seasonal, Temperature, Cooling water, Powerplants, Movement, North Carolina.

Identifiers: *Entrainment(Plankton), *Marshall Steam Station(NC), Lake Norman(NC).

This study was concerned with an evaluation of the effects of pumped entrainment on zooplankton passing through the cooling water system of the Marshall Steam Station. Samples were collected at the intake and discharge of the power plant. Motility of organisms in the samples was usually correlated with the changes in water temperature from the intake to the discharge side and the ambient temperature of the water before it passed through the power plant. Linear regression lines for corrected percent motility(assumed to reflect only the effects of passage through the cooling system) versus ambient temperature and thermal elevation were drawn for dominant organisms, life stages of copepods, and major categories of zooplankton. Motility in discharge samples was re-lated to both the amplitude of the thermal elevation and seasonal changes in ambient temperature. Motility of zooplankton in the discharge showed no significant decrease except at lower ambient winter temperatures. Large elevations above ambient water temperature in winter months appeared to be more damaging than lesser elevations during warmer periods that produce the same discharge canal temperature as zooplankton populations apparently become acclimated to lower ambient temperatures in the winter months. (See also W76-05870) (Chilton-ORNL)

BENTHIC INVERTEBRATES,

Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering. R. W. Koss, L. D. Jensen, and R. D. Jones.

In: Environmental Responses to Thermal Discharges from Marshall Steam Station, Lake Norman, North Carolina. p 173-186, April 1974. 10 fig. 3 tab.

Descriptors: *Environmental effects, *Thermal pollution, *Benthic fauna, *Aquatic populations, *Biomass, Productivity, Biota, Worms, Midges, Mayflies, Dragonflies, Caddisflies, Oligochaetes, Diptera, North Carolina.

Identifiers: *Species diversity, Chironomidae, Marshall Steam Station(NC), *Lake Norman(NC).

The Oligochaeta (worms) and Chironomidae (midges) were the most abundant benthic invertebrates found in Lake Norman with small populations of caddisflies, mayflies, and dragonflies also observed. Thermal effluents from Marshall Steam Station were not a negative influence on the benthic invertebrate fauna. Natural thermal stratification prevented the heated effluent from contacting any significant amount of the Lake Norman substrate even in the discharge canal. In the discharge canal and its near vicinity, the heated effluent does seem to have affected the character of benthic populations. Species diversity seems to have been lowered and the primary influence seems to be a slight increase in energy production at those shoreline and restricted subsurface areas that are influenced by the discharges from the plant. The thermal effluent seems to stimulate the populations of benthic invertebrates in these areas and do not seem to be damaging to the biota of the lake. (See also W76-05870) (Chilton-ORNL)

FISHERIES RESEARCH,

Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering. R. W. Miller, and D. J. DeMont.

In: Environmental Responses to Thermal Discharges from Marshall Steam Station, Lake Norman, North Carolina. p 187-216, April 1974. 21 fig, 26 tab. Descriptors: *Thermal pollution, *Environmental effects, *Fish, *Temperature, *Dissolved oxygen, Seasonal, Rough fish, Bass, Aquatic fungi, Nitrogen, North Carolina. Identifiers: Fungus infections, Gas-bubble dis-

Identifiers: Fungus infections, Gas-bubble disease, Marshall Steam Station(NC), *Lake Norman(NC).

This study was undertaken to discover some ways in which the heated effluent from Marshall Steam Station affects the fishes of Lake Norman. Fish samples suggested that temperatures per se were not affecting abundance and well being of fish in the discharge area. Dissolved oxygen concentrations in the discharge area were often below 1 mg/l during the summer stratified period when surface temperatures in the downlake mixing area were at maximum seasonal levels, causing summer catch composition to be dominated by rough species. During winter months, dissolved oxygen concentrations approached air saturation and were no longer a factor controlling fish abundance. Game fish showed attraction for the discharge in winter and spring with white bass abundance being positively correlated with temperature increase above ambient. In winter, conditions in the discharge were conducive to fungus infections. Gas-bubble disease caused by dissolved gas supersaturation (most likely nitrogen) resulted in fish mortalities. (See also W76-05870) (Chilton-ORNL)

RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT -ECOLOGY, JANUARY-DECEMBER 1974. Argonne National Lab., Ill. Radiological and En-

vironmental Research Div.

Available from the National Technical Information Service, Springfield, Va 22161 as ANL-75-3 Part III, \$4.00 in paper copy, \$2.25 in microfiche. ANL-75-3. Part III (1975) 185 p. W-31-109-Eng-38.

Descriptors: *Ecology, Ecosystems, Path of pollutants, *Research and development, Nuclear powerplants, Watersheds(Basins), *Plutonium, Sediments, Fish, Temperature, Lake Michigan, Migratory patterns, Limnology, Water pollution effects, Environmental effects.

Highlights of research accomplishments by the Ecology Section during 1974 are given. Included are reports on a new program to assess the behavior of plutonium in a watershed that has received plutonium from a nuclear facility as well as from fallout and a smaller program to determine the chemical and physical forms in which transuranic elements exist in natural waters. Other programs include an investigation of the role of plankton in the processes of transport and removal of energy-related pollutants in the Great Lakes. Studies on the migratory behavior of salmonids and on their temperature selection and residence times in thermal discharges are reported. (See W76-05880 thru W76-05902) (Chilton-ORNL)

ROLE OF COPEPOD FECAL PELLETS IN THE VERTICAL TRANSPORT OF FRESHWATER DIATOMS,

Argonne National Lab., Ill. Radioological and Environmental Research Div.
J. G. Ferrante, J. I. Parker, and J. S. Marshall.

In: Radiological and Environmental Research Division Annual Report Ecology, January through December, 1974. p 1-8, 1975 8 fig, 8 ref. W-31-109-Eng-38.

Descriptors: *Environmental effects, *Sediment transport, Sediments, *Copepods, *Diatoms, Freshwater, Zooplankton, *Lake Michigan, Water pollution effects, Lake sediments, Lakes. lettifiers: Transport mechanism, *Fecal pellets(Copedods), Frustules.

Copepod fecal pellets were collected from various strata of Lake Michigan to study their significance

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as a vertical transport mechanism for pelagic diatoms. Copepod fecal pellets were found to have a relatively impermeable peritrophic membrane which retarded the rate of dissolution of diatom fragments as the pellets sank. Photomicrographs tragments as the pellets sank. Protomicrographs indicated that bacterial decomposition of the membrane exposes the frustules to dissolution and eventual dispersion in the water column. It was concluded that zooplankton fecal pellets are an important mechanism for accelerated transport of diatom frustules from the epilimnion of the lake. diatom frustules from the epilimnion of the lake. Most of the pellets do not become incorporated intact in the permanent sediments. Zooplankton grazing fractures most ingested diatom frustules, and subsequent bacterial degradation of peritrophic membrane exposes the fragments to dissolution within the water column. (See also W76-05879) (Chilton-ORNL)

VERTICAL TRANSPORT OF PARTICULATE MATERIAL IN LAKE MICHIGAN BY THE LORICA OF CODONELLA CRATERA,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

and Environmental Research Div.
J. I. Parker, and J. G. Ferrante.
In: Radiological and Environmental Research
Division Annual Report-Ecology, January through
December 1974. p 9-12, (1975). 3 fig, 7 ref. W-31-

Descriptors: *Environmental effects, *Sediment transport, *Diatoms, Zooplankton, Freshwater, Sediments, Particle size, Lake Michigan, Lake sediments, Lakes.

Identifiers: Transport mechanism, *Codonella cratera, Lorica.

Investigations into the abundance and distribution of Codonella cratera showed a range from 16 or-ganisms per liter in surface waters to 6 organisms per liter in deeper waters. Approximately 3.0 zooplankton crustaceans were observed in the same surface water samples. Particle size of foreign material attached to or imbedded within the matrix of the lorica of Codonella ranged from less than 1.0 micron to a maximum size of 10.0 microns. The upper limit of particle size in all lorica observed was uniform. The major group of parica observed was uniform. The major group of par-ticles were mineral fragments while the secondary group constituted whole diatom frustules and frag-ments of frustules. Codonella are smaller than most zooplankton but they were found in greater numbers during certain seasons. Occurrence of the diatom-containing lorica in sediment illustrates that Codonella remove diatoms from the water column. The particulate material on the lorica may be important as sorptive sites for transport of taxic be important as sorptive sites for transport of toxic materials from the surface water. (See also W76-05874) (Chilton-ORNL)

DISTRIBUTION OF DIATOM FRUSTULES IN LAKE MICHIGAN SEDIMENT CORES, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

J. I. Parker, and D. N. Edgington.
In: Radiological and Environmental Research
Division Annual Report-Ecology, January through
December 1974. p 13-18, (1975). 2 fig, 1 tab, 18 ref.
W-31-109-Eng-38.

Descriptors: *Environmental effects, *Diatoms, *Trophic level, *Cores, Freshwater, Silica, Sam-pling, Recycling, Sediments, Lake Michigan, Lake sediments, Lakes, Distribution patterns. Identifiers: Frustules.

The objectives were to measure the concentration of diatom frustules in Lake Michigan sediment cores and to consider their role in silica recycling. The concentration of diatom frustules was measured as a function of depth in 14 selected sediment cores. The concentration of frustules in surficial sediment varied between 0.08 and 4.95% dry weight in nearshore and offshore samples, respec-

tively. It did not appear that floristic changes in sediment frustules could be used as an indicator of trends or changes in trophic status for Lake Michigan over the last 100 years. The similar verti-cal profiles of diatom concentrations at all stations suggested that an active silica dissolution process has been occurring in both the water column and the sediment for that length of time. Reduced dis-solved silica concentrations in the surface water may be the result of increased diatom standing crop. The sediment does not seem to be an effec-tive sink for amorphous silica in the form of diatom frustules. Investigations of the processes of diagenesis and concentration of silica in intersti-tial water are in progress. (See also W76-05879) (Chilton-ORNL) W76-05882

DISTRIBUTION OF AMORPHOUS, DIATOM FRUSTULE, AND DISSOLVED SILICA IN A LEAD-210 DATED CORE FROM SOUTHERN LAKE MICHIGAN, Argonne National Lab., Argonne, Ill. Radiological

Argonne National Lab., Argonne, Ili. Radiological and Environmental Research Div.

J. A. Robbins, D. N. Edgington, and J. I. Parker.

In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 19-31, (1975). 4 fig, 1 tab, 20 ref. W-31-109-Eng-38.

Descriptors: *Environmental effects, *Silica, *Distribution, *Sediments, *Cores, Diatoms, Lead, Models, Lake Michigan, Lake sediments, Lakes, Distribution patterns. Identifiers: *Frustules.

In order to assess the effect and significance of dissolution of frustule silica and to compare regeneration of interstitial silica from biogenic phases with contributions from solution of clay minerals, Pb210 and amorphous, diatom, and dis-solved silica were measured in the same sediment core. The Pb210 data indicated an unsupported level of about 0.9 pCilg and some flattening of the activity within the upper 2.5 cm. Examination of the frustule silica distribution showed no comparable flattening within this interval and it was concluded that mixing had occurred in the core but that frustules were partially immune to its effects. The dissolved silica concentrations several centimeters below the sediment surface rose by roughly 100 over concentrations of a few tenths ppm in overlying water. Interstitial silica concentrations were shown to be maintained by interaction of clay minerals with silica produced by the dissolution of frustules and by diffusion. Diffusion reaction models for understanding the processes controlling the distribution of silica among sedimentary components are discussed. (See also W76-05874) (Chilton-ORNL) W76-05883

STABLE LEAD GEOCHRONOLOGY OF FINE-GRAINED SEDIMENTS IN SOUTHERN LAKE MICHIGAN,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05884

GEOCHRONOLOGY OF LAKE MICHIGAN SEDIMENTS: ANOMALIES IN LEAD-210 DIS-TRIBUTIONS,

Michigan Univ., Ann Arbor. For primary bibliographic entry see Field 5B. W76-05885

MIAMI RIVER WATERSHED PROJECT: IN-TRODUCTION,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05886

PLUTONIUM CONCENTRATIONS IN WATER AND SUSPENDED SEDIMENT FROM THE MIAMI RIVER WATERSHED, OHIO, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

For primary bibliographic entry see Field 5B. W76-05887

PLUTONIUM IN AQUATIC BIOTA OF THE GREAT MIAMI RIVER WATERSHED, OHIO, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

C. W. Wayman, G. E. Bartelt, and D. N.

Edgington.

In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 78-86, (1975). I fig, 4 tab, 16 ref. W-31-109-Eng-38.

Descriptors: *Plutonium, *Food chain, *Aquatic environment, Biota, Fish, Algae, Pondweeds, Carp, *Ohio, Environmental effects. Identifiers: *River ecosystems, *Miami River Watershed Project(Ohio), Goldfish, Cladophora.

Analyses were made of plutonium concentrations in Cladophora sp., Potamogeton sp., goldfish, carp, and miscellaneous cyprinids collected from the Miami River from June to August, 1974. Based on these analyses, there appeared to be discrimination against plutonium moving up in the food chain. Concentration of plutonium by algae and macrophytes is 100 to 1000 that of fish. An average of 80% of Pu238 found in carp is associated with the gastrointestinal tract and contents. Consequently, the plutonium located in the fish muscle is minimal. Since plutonium uptake by Cladophora sp. is thought to be rapid and dependent on the immediate concentration in the water, a single release of plutonium could be monitored dent on the immediate concentration in the water, a single release of plutonium could be monitored by Cladophora sp. Uptake of Pu238 by fish occurs over a longer period of time and would not be significantly influenced by a single effluent release. (See also W76-05879) (Chilton-ORNL) W76-05888

THE CHEMICAL SPECIATION OF PU-239, PU-240 AND CS-137 IN LAKE MICHIGAN WATERS,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05889

EFFECT OF MUNICIPAL TREATMENT PROCESSES ON PU-239, PU-240, AND CS-137, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5F.

SEDIMENTARY PU-239, PU-240 PHASE DISTRIBUTIONS IN LAKE MICHIGAN SEDI-

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05891

THE DISTRIBUTION OF PLUTONIUM IN LAKE MICHIGAN SEDIMENTS, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. For primary bibliographic entry see Field 5B. W76-05892

DEVELOPMENTS IN UNDERWATER RADIOTELEMETRY AND PRELIMINARY FISH TRACKING IN THERMAL PLUMES, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. W. Prepejchal, J. Haumann, and S. A. Spigarelli.

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION Group 5C-Effects Of Pollution

In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974, p 128-132, (1975), 1 fig, 3 ref. W-31-109-Eng-38.

Descriptors: *Thermal pollution, *Salmonids, *Physiological ecology, *Data transmission, Fish, Monitoring, Temperature, Telemetry. Identifiers: *Behavioral therm thermoregulation. Tracking, Transmitters.

Fish were collected from thermal discharge sites, fitted with transmitters and released back into the flume. Fish location as well as physical and physiological parameters were monitored. During the tracking time, fish often moved through large temperature gradients in passing from ambient to plume water. Limited tracking of rainbow trout showed little or no evidence of behavioral ther-moregulation but did demonstrate the ability of adult salmonids to traverse large temperature gradients with no great effect on internal body temperature. (See also W76-05879) (Chilton-W76-05893

COMPARISON OF THE MOVEMENT AND RECAPTURE OF SALMONID FISHES TAGGED AT TWO POWER PLANTS,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

G. P. Romberg, and M. M. Thommes In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 133-142, (1975), 7 fig, 3 tab, 5 ref. W-31-109-Eng-38.

Descriptors: *Thermal water, *Salmonids, *Migratory patterns, *Nuclear powerplants, Fish, *Salmonids, Seasonal, Sites, Tagging, Fish populations, Salmon, Trout, *Thermal pollution.

Identifiers: Point Beach Nuclear Plant, Waukegan Power Plant.

The fish tagging program was directed at determining whether there were any seasonal or site specific differences in the residence behavior of salmonids at thermal discharges. It was concluded that there were differences in the abundance and time of peak abundance at the two power plant discharges. Because of this difference in timing, certain species reacted differently to the two discharges probably as a result of maturity and water temperature. Salmonids did not appear to remain at either discharge for long periods and many of those fish migrating away were caught at other power plant discharges. Direction of migration was affected by stocking location and water temperature. Differences in the annual migratory behavior of brown trout and rainbow trout affected the proximity of these fish to Point Beach. (See also W76-05879) (Chilton-ORNL) W76-05894

ORIGIN OF FIN-CLIPPED SALMONIDS COL-LECTED AT TWO THERMAL DISCHARGES ON LAKE MICHIGAN, Argonne National Lab., Argonne, Ill. Radiological

and Environmental Research Div.

G. P. Romberg, M. M. Thommes, and S. A. Spigarelli

In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 143-149, (1975). 4 tab, 5 ref. W-31-109-Eng-38.

Descriptors: *Migration patterns, *Salmonids. *Marking techniques, Tagging, Stocking, Salmon, Trout, Lake Michigan, Thermal pollution. Identifiers: Point Beach Nuclear Plant, Waukegan Power Plant.

Fin-clip marking procedures were used to provide insight into fish migration patterns. Data on fish collected at discharges and creel cesus data were tabulated by species. The data on lake trout suggested that most of these fish captured at the two power plant discharges were stocked in that general area of the lake and often returned to the stocking location prior to spawning. In the case of rainbow trout, the majority of identified clips could be accounted for by Wisconsin stockings. The occurrence of several clips stocked in Indiana and Michigan indicates that some rainbow trout migrate considerable distances from their origin. The data on brown trout suggested stockings to the north of Point Beach and Waukegan. Relatively few coho salmon were collected at Point Beach and none bore fin-clips. Of the 182 coho collected at Waukegan in 1974, three were fin-clipped. (See also W76-05879) (Chilton-ORNL) W76-05895

EFFECTS OF SEASON, LOCATION, AND DISCHARGE TYPE ON FISH DISTRIBUTION AND DENSITY IN THERMAL PLUMES,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

W. Prepejchal, G. P. Romberg, and S. A

In: Radiological and Environmental Research Division Annual Report - Ecology, January through December 1974. p 150-154, (1975) 1 tab, 6 ref. W-31-109-Eng-38.

*Thermal water, *Distribution, *Sites, Migration patterns, Fish, Salmonids, Forage fish, Lake Michigan, Contours, Depth, *Thermal pollution.
Identifiers: Point Beach Nuclear Plant, Waukegan

Power Plant, Zion Station.

Techniques used in this investigation involved a combination of standard plume mapping and sonar procedures. For each study the density of fish in the plume areas and reference areas were compared in terms of total area density, distribution relative to bottom depth, depth in the water column, and water temperature. Overall fish density indicated low density in all areas in April, maximum density in May and June (attributed to alewives migrating inshore to spawn) and reduced densities during July through October. During the salmonid spawning periods there was no evidence of increased density of salmonids in the plumes. Site comparisons showed that Point Beach had higher plume density in May and June while Wau-kegan and Zion had higher plume density from July through September. There was no striking trend in fish distribution relative to bottom depth and depth stratum but there were subtle differences between dates and locations, reflecting differential responses with time, species, and discharge type. (See also W76-05879) (Chilton-ORNI W76-05896

CHARACTERISTICS OF TEMPERATURE-SEN-

SITIVE FISH TAGS USED IN 1974, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div

G. P. Romberg, and W. Prepejchal. In: Radiological and Environmental Research Division Annual Report - Ecology January through December 1974. p 155-160, (1975) 3 fig, 4 ref.

Descriptors: *Marking techniques, *Temperature, *Fish, *Tagging, Irradiation, Thermal stress, Thermal pollution.

Special order Teflon rods containing 8% Special order felion rods containing 8% CaSO4:Mn by weight were manufactured for 18% as predosed thermoluminescent dosimeters (TLD's). The TLD's were used for determining maximum discharge residence time and indications of integrated average temperature exposure. Previously used TLD fish tags exhibited individual variability and a nonlinear relationship between temperature and fade response which limited their application. The relationship between fade response of the tags used in the 1974 study and temperature was more clearly defined through the

use of additional laboratory controls. The variation between rods was far greater than the specified 4% maximum range for weight and light response. This high variability masked small reductions in variability due to improved methods. (See also W76-05879) (Chilton-ORNL) W76-05897

DISCHARGE RESIDENCE OF TLD TAGGED

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div. G. P. Romberg, and W. Prepejchal.

Hr. Radiological and Environmental Research Division Annual Report - Ecology, January through December 1974. p 161-163, (1975) 1 fig, 3

*Thermal *Marking Descriptors: water. techniques, *Temperature, Salmonids, Tagging, Creel census, Data collections, Lake Michigan, Thermal pollution.

Identifiers: *Residence times, Point Beach

Nuclear Plant.

A total of 522 fish were collected from two discharge flumes and tagged with temperaturesensitive tags. Tagged fish were recaptured from the discharge by selective spearing, from fisher-men, and from personnel conducting a creel census. Of 122 temperature-sensitive tags recaptured, only 43 were obtained soon enough after recapture to be properly stored for analysis. Preliminary analysis indicated that calculated maximum discharge esidence for these fish will be nearly 100% of the elapsed time. Brown trout appeared to have had longer residence in warmer water than did rainbow trout. Lower discharge temperatures during 1974 (12.4 to 18.8 degrees C) compared to 1973 (18.7 to 25.1 degrees C) are closer to preferred salmonid temperatures and may account for the apparent longer residence times for fish in 1974. (See also W76-05879) (Chilton-ORNL) W76-05898

BODY TEMPERATURE CHANGE CHARAC-

TERISTICS OF LAKE MICHIGAN FISHES, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

S. A. Spigarelli, M. M. Thommes, and T. L.

Beitinger.
In: Radiological and Environmental Research
Division Annual Report - Ecology, January
through December 1974. p 164-168, (1975) 3 fig, 1
tab, 4 ref. W-31-109-Eng-38

Descriptors: *Fish, *Temperature, *Stabilization, *Thermal water, Trout, Carp, Size, Weight, Cooling, Heating, Lake Michigan, Thermal pollution. Identifiers: Body temperature, Change rates, Alewife.

The rates of body temperature change and the half-time for temperature stabilization were calculated for 5 specie of fish: alewife, brown trout, rainbow trout, brook trout, and carp. Relationships between half-time, weight, and species are reported. Increases in size resulted in increased half-times. Mean heating half-times of each specie were smaller than their corresponding mean cooling half-times. The temperature change rate is related to fish size, species and direction of change. (See also W76-05879) (Chilton-ORNL) W76-05899

BODY TEMPERATURES OF FISH FEEDING IN THE POINT BEACH THERMAL DISCHARGE, Argonne National Lab., Argonne, Ill. Radiological

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and Environmental Research Div. S. A. Spigarelli, and M. M. Thommes.

In: Radiological and Environmental Research Division Annual Report - Ecology, January through December 1974. p 169-172, (1975) 1 tab, 3 ref. W-31-109-Eng-38

Descriptors: *Thermal water, *Temperature, *Fish, Measurement, Lake Michigan, Thermal pollution.
Identifiers: Feeding, Body temperature.

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Identifiers: Feeding, Body temperature, *Thermoregulation, Point Beach Nuclear Plant.

Records were made on 1310 fish of fish weight, length, sex and internal body temperature at time of capture; and of intake and discharge temperatures at that time. Mean monthly body tempera-tures indicated both temporal and taxonomic dif-ferences in feeding temperatures. In most cases, body temperatures were higher than intake tem-peratures indicating that feeding fish were either warming after recent movement from ambient waters into the plume or thermoregulating at selected intermediate temperatures. Measure-ments of fish body temperature showed that, under most conditions, fish were not equilibrated to maximum discharge temperatures. (See also W76-05879) (Chilton-ORNL) W76-05900

GROWTH OF PLUME RESIDENT FISHES IN LAKE MICHIGAN, Argonne National Lab., Ill. Radiological and En-

Argoine National Lab., in. Radiological and Environmental Research Div. S. A. Spigarelli, and D. W. Smith. W-31-109-Eng-38. In: Radiological and Environmental Research Division Annual Report-Ecolometrial Research Division gy, January through December 1974. p 173-179, (1975) 1 fig, 2 tab, 10 ref.

Descriptors: *Thermal water, *Growth rates, *Salmonids, Fish, Trout, Lake Michigan, Chinook, Thermal pollution.

Identifiers: Residence times, Growth indicators, RNA-DNA ratio, Feeding regimes, Thermoregulation, Point Beach Nuclear Plant.

The technique of using RNA-DNA ratio as an indicator of growth was applied to studies of growth effects on thermal discharge 'resident' fish. The data suggested that plume brown trout were growing at a faster rate than average control brown trout; plume rainbow trout were growing at a similar rate to control rainbows; and plume chinook resembled the slowest growing control group. In general, K-factors indicated that plume fish were in similar condition to control fish. The fact that these fishes were exposed to elevated tem-peratures for varying periods of time indicates that this discharge does attract salmonids under certain conditions during the fall, but that accelerated metabolic demands are compensated by food availability and the ability of motile fish to regulate their temperature exposures behaviorally. (See also W76-05879) (Chilton-ORNL) W76-05901

EFFECT OF PLUME RESIDENCE ON THE AC-CUMULATION OF CS137 BY LAKE MICHIGAN SALMONIDS,

Argonne National Lab., Ill. Radiological and En-

vironmental Research Div.
S. A. Spigarelli, and J. Edwards.
W-31-109-Eng-38. In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 180-183, (1975) 1 tab, 7 ref.

Descriptors: *Cesium, *Salmonids, Radioisotopes, Fallout, Fish, Trout, Chinook, Lake Michigan, Thermal pollution. Identifiers: *Plume residence, Point Beach

Brown trout, rainbow trout, and chinook salmon were collected, tagged with temperature-sensitive tags and released into the discharge area. Upon recapture, measurements of Cs137 were made on the fish. Comparisons between plume resident fish and reference fish were made using covariance techniques (fish weight as covariate). The relationship between exposure time and Cs137 activity was tested by linear regression analysis. Brown

trout and chinook salmon had significantly higher concentrations of Cs137 than rainbow trout. The differences were thought to be the result of dif-ferential feeding habits or trophic position rather than a reflection of plume exposures since these same trends were evidenced in reference samples. (See also W76-05879) (Chilton-ORNL) W76-05902

CONTAMINATION OF FRESHWATER BY

MN54 AND CO60, Commission of the European Communities, Brus-Commission of the European Communities, Brussels (Belgium); and Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). C. Nicolas, and R. Kirchmann.

Available from the National Technical Informa-tion Service, Springfield, Va 22161, as EUR 5167E, \$4.00 in paper copy, \$2.25 in microfiche. Buratom 095-72-1 BIOB. EUR 5167 e, (197). 35 p, 18 fig, 6 tab, 10 ref.

Descriptors: *Environmental effects, *Water pollution effects, *Radioisotopes, Freshwater fish, Cobalt, Manganese, Minnows, Nuclear powerplants, Europe. Identifiers: *Meuse River.

Minnows inhabiting the Meuse River (which receives radioactive wastes from nuclear power plants) were examined for contamination by Co60 and Mn54. Both radioisotopes entered live fish rapidly with maximum contamination being reached within a few days after fish-radioisotope contact. Fed fish accumulated more of both radioisotopes and at a faster rate than did starving fish. Take-up of both Mn54 and Co60 by dead fish was ten times the take-up by live fish, probably due to the lack of regulating mechanisms which exist in live fish. The contamination curve for dead fish was more regular than that for live fish. No peak of activity was registered during a 16 day contamination period. Activity distribution in organs was studied, Mn54 was retained primarily in external organs while Co60 is taken up by the kidneys and control tracts. When converged code neys and genital tracts. When compared on a weight basis, muscles were relatively little con-taminated. (Chilton - ORNL) W76-05903

EFFECT OF CACODYLIC ACID AND MSMA ON MICROBES IN FOREST FLOOR AND SOIL, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. W. B. Bollen, L. A. Norris, and K. L. Stowers. Weed Science, Vol. 22, No. 6, p 557-562, November 1974. 4 fig, 3 tab, 22 ref.

Descriptors: *Arsenicals(Pesticides, *Toxicity, Herbicides, Forest management, *Forest Soils, Brush control, Arsenic compounds, Bacteriacides, Organic matter, *Soil microorganisms, Carbon

Identifiers: Carbon dioxide evolution, *Cacodylic

Cacodylic acid (hydroxydimethylarsine oxide) and MSMA (monosodium methanearsonate) gave slightly visible inhibition of bacterial growth in pure culture at 1000 mg/L arsenic. and moderate inhibition at 10,000 mg/L arsenic. There were no effects at 100 mg/L arsenic. Carbon dioxide evolution from three kinds of forest floor declined with integrating acceptability of MSMA and exactly in the carbon dioxide acceptability. increasing concentrations of MSMA and cacodylic acid. Increasing concentrations of MSMA caused an increase in carbon dioxide evolution from soil but cacodylic acid had no effect. Concentrations less than 10 mg/kg arsenic forest floor including L, F, and H horizons, or soil had no pronounced effect on organic matter decomposition. (Forest Service) W76-05940

MIREX RESIDUES IN SELECTED ESTUARIES OF SOUTH CAROLINA: JUNE 1972, Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.

For primary bibliographic entry see Field SA

LAKE WINGRA, 1837-1973: A CASE HISTORY

OF HUMAN IMPACT, Univ. Wis., Madison, Wisconsin Univ., Madison. P. C. Baumann, J. F. Kitchell, J. J. Magnuson, and T. B. Kaves.

Trans Wis Acad Sci Arts Lett. 62: 57-94. Illus.

Descriptors: *Ecosystems, Eutrophication, Wisconsin, Lakes, History, Bass, Bluegill, Macrophytes, Perch, Pike.
Identifiers: Milfoil, *Lake Wingra(Wisc).

Lake Wingra is a shallow, eutrophic lake bordered on one side by the city of Madison and on the other by the University of Wisconsin Arboretum. The history of the biological and hydrographic changes which occurred in the lake between 1837-1973 is recounted. In the early 1900's, the area, depth and drainage patterns of the lake and adjoining wetlands were extensively altered by the activities of man. Early management practices (e.g. introduction of carp in the late 1800's, fish rescue and stocking operations during the 1930's and carp removal programs during the 1930's, 1940's and 1950's) had marked and often unexpected effects. The lake once had extensive bordering marshes, diverse aquatic macrophyte communities and large northern pike and yellow perch populations. It now has few connecting marshes, dense stands of Eurasian water milfoil ans is dominated by stunted bluegill and yellow bass. The number of macroinvertebrate species has been reduced; many larger forms have been eliminated. Since 1969, Lake Wingra and its watershed have been a major study site of the International Biological Program. Ecosystem concepts derived from this project and the lessons of history may facilitate more ecologically sound management decisions.--Copyright 1975, Biological Abstracts, Inc. W76-05997

BRACKISH-WATER PHYTOPLANKTON RESPONSE TO TEMPERATURE ELEVATION, Woods Hole Oceanographic Institution, Mass.

E. J. Carpenter.

Estuarine Coastal Mar Sci. 1(1): 37-44, 1973.

Descriptors: *Phytoplankton, Plankton, *Brackish water, Powerplants, Temperature, *Heated water, Thermal pollution, North Carolina, Dinoflagel-

Identifiers: Pamlico River(NC).

An experiment was carried out to determine the effects of a temperature increase on the composition of brackish-water phytoplankton populations. Treatments were partitioned in duplicate and results were tested at the 95% confidence level with a randomized-block analysis of variance. The studies were made between 9 Feb.-18 April 1970 in four 14-m3 plastic pools located adjacent to the Pamlico River estuary, North Carolina, USA. Temperatures in the 2 control pools ranged from 5-19C and in heated pools from 10-27C during the study. Heated pools averaged 5.5C warmer than unheated. The only statistically significant effect noted on phytoplankton class composition was an increase in the dinoflagellate cell concentrations in the heated pools. Phytoplankton populations in the heated pools were more diverse and were com-posed of larger cells (cells averaged 5.2 times larger in volume) than in controls. It appeared that the warming tended to accelerate the succession of the late winter-early spring population and produced a more mature successional stage. Thus the warming of brackish water, possible by heated effluents form electric generating plants, can alter the composition of phytoplankton populations.--Copyright 1975, Biological Abstracts, Inc. W76-05999

Group 5C-Effects Of Pollution

TEMPERATURE OPTIMUM OF ALGAE LIV-ING IN THE OUTFALL OF A POWER PLANT

ON LAKE MONONA, Wisconsin Univ., Madison. T. D. Brock, and J. Hoffmann.

Trans Wis Acad Sci Arts Lett. 62: 195-203. Illus.

Descriptors: *Algae, Cladophora, Lakes, Outlets, *Powerplants, *Heated water, Thermal pollution, Temperature, Photosynthesis.
Identifiers: Lake Monona, Oscillatoriaceae, Stigeoclonium, Ulothrix, Yahara River.

Temperature optima for photosynthesis were mea sured for algal populations living in the outfall of an electric power plant on Lake Monona and were compared with the temperature optima of algae living in a control area in the nearby Yahara River. The temperature of the power plant outfall averaged about 8C higher than that of the Yahara River. In the winter, no differences in species composition between the 2 study areas could be detected, Cladophora and Ulothrix being the dominant algae. The temperature optima of the populations from the 2 locations were the same, around 27C, although the habitat temperatures at both locations were considerably lower. The only difference in response to temperature seen between the 2 populations was that the population at the outfall was able to photosynthesize at higher temperature, still showing high photosynthesis at 35C and detectable photosynthesis at 46C, a temperature at which the population from the Yahara River showed no detectable photosynthesis. In the summer, the dominant algae at the power plant outfall were Stigeoclonium and filamentous blue green algae (family Oscillatoriaceae), whereas at the Yahara River the algal population was almost exclusively Cladophora. The temperature optima of both summer populations were the same, 31.5C, only slightly higher than the mid-winter optima. Again, the population from the power plant was able to photosynthesize at higher temperature than the control population, showing quite active photosynthesis at 42.5C, a temperature at which the population from the Yahara River was completely inactive. These results are discussed in relation to the possible environmental impact of power plants on Wisconsin lakes and rivers .--Copyright 1975, Biological Abstracts, Inc. W76-06001

NEMATODES OF LAKE BALATON: IV. SEASONAL QUALITATIVE AND QUANTITA-TIVE CHANGES

Research Inst. for Water Resources Development, Budapest (Hungary). Water Quality and Technology Dept. K. Biro.

Ann Inst Biol (Tihany) Hung Acad Sci. 40: 135-158, 1973.

Descriptors: *Nematodes, *Lakes, *Lake beds, Seasonal, Fluctuations, Europe, Lake sediments. Identifiers: Ironus-tenuicaudatus, Lake Balaton, Monhystera-paludicola, Paraphanolaimus-anisitsi, Paraphanolaimus-behningi, Paraplecto pedunculatum, Theristus-setosus, Hungary. Paraplectonema-

In the open-water sediment of Lake Balaton the following nematodes predominated during 1966-68: Paraplectonema pedunculatum S. (20%), Paraphanolaimus behningi M. (20%), Ironus tenu-icaudatus dM. (19%), Theristus setosus (B.) M. (17%), Monhystera paludicola dM. (15%). Their occurrence varies by seasons: during winter (between 4-12C) T. setosus and M. paludicola are the most frequent species, while during summer they are absent at some places. A rare species, P. anisitsi (D.) Andrassy 1968 was also observed in the sediment of the lake. The highest number of nematodes was found in spring (May), 60-80,000 i individuals)/m2, there was a gradual decrease during summer 10-20,000 i/m2, then from the middle of autumn (October) there was an increase again. During winter 100,000 i/m2 nematodes were

observed under the ice at Tihany. The biomass of nematodes varied between 4-20 mg/m2. Generally this value is nearly twice as high in spring as in this value is nearly twice as high in spring as in summer, it is the lowest usually in early autumn (4-6 mg/m2) and then slowly increases. The highest value of biomass was found at Balatonszemes. On the basis of the benthic fauna, Lake Balaton can be divided into 3 regions; the northeastern basin, the Keszthely-Bay and the central part of the lake.—Copyright 1975, Biological Abstracts, Inc. W76-06004

OCCURRENCE OF PHYTOPHTHORA SPECIES AND OTHER POTENTIAL PLANT PATHOGENS IN RECYCLED IRRIGATION WATER

California Univ., Berkeley. Dept. of Plant Patholo-S. V. Thomsom, and R. M. Allen.

Plant Dis Rep. 58(10): 845-949. 1974.

Descriptors: *Arizona, *Recycling, *Irrigation water, *Pollutant identification, Citrus, Plant pathology, Phytoxicity, Seasonal, Fungi. Identifiers: Pathogens, Phytophthora-Citrophthora, Phytophthora-Parasitica, *Phytophthora-Spp.

Sieves and citrus leaf baits were used to isolate Phytophthora parasitica, P. citrophthora and Phytophthora spp. of uncertain identity from waste irrigation water being collected in sumps for cycling to citrus orchards near Phoenix, Arizona (USA). Occurrence of the Phytophthora species was seasonal and dependent on ambient water temperatures. Species representing 47 genera of fungi also were isolated from waste water using a dilution plate technique. Twenty-two of these genera contained species which are associated with plant diseases. Species of fungi associated with citrus diseases, however, were most frequently isolated.--Copyright 1975, Biological Abstracts, Inc. W76-06010

LIMNOLOGICAL CHARACTER OF EXPERI-MENTAL RESERVOIRS TREATED WITH TRITOX 30% (DDT, DMDT, GAMMA HCH), National Inst. of Hygiene, Warsaw (Poland). Dept. of Communal Hygiene.

I. Cabejszek, J. Luczak, J. Maleszewska, and J.

Stanislawska Ekol Pol 21(8): 121-140 1973

Descriptors: Limnology, Bacteriology, Reservoirs, *DDT, Physicochemical properties, Pesticides, Pesticide toxicity. Identifiers: Gamma HCH, Limnological, Methoxychlor, Reservoirs, Treated, *Tritox, *DMDT.

Hydrobiological, bacteriological physicochemical studies were conducted on water bodies experimentally 'polluted' with Tritox 30% composed of the active substances DDT, DMDT (methoxychlor) and gamma (hexachlorocyclohexane).--Copyright Biological Abstracts, Inc. HCH gamma 1975. W76-06012

LIMNOLOGICAL FEATURES OF A TROPICAL IMPOUNDMENT, BHAVANISAGAR RESER-VOIR (TAMIL NADU), INDIA,

Hydrobiological Research Station, Madras (India). A. Sreenivasan. Int Rev Gesamten Hydrobiol. 59(3): 327-342. 1974.

Descriptors: Limnology, Dissolved oxygen, Impoundments, Tropic, Production, Fish, Reservoirs, Nitrogen, Thermocline. Identifiers: Bhavanisagar Reservoir(India).

Bhavanisagar Reservoir was studied for the period 1962-1966. Stable thermal stratification did not occur, but on rare occasions an ephemeral nar-row thermocline was formed. Thermal stability (relative thermal resistance) was fairly high. Dissolved O2 was well over 50% saturation at the surface and, on some occasions, mild supersaturations were noted. Oxygen deficits occurred often, as well as complete anoxic conditions on many oc-casions. Influx of flood waters improved the bottom O2 conditions. Anox waters from the bottom issuing from the low level outlets regained a high O2 content in a distance of 100 m. Methyl orange alkalinity and pH varied with depth, diurnally and seasonally. Hypolimnial O2 depletion was accom-panied by increased bicarbonate and electrical conductivity at the bottom. All of these factors indicate a high level of metabolic activity and productivity. The pH value of the surface water never fell below 7.0 except on 1 day. The reservoir appeared to be nutrient-poor but high organic nitrogen was a characteristic of this water. It increased at the bottom. Primary production rates were fairly high, the mean of 23 estimates being 6.0 g O2/m2/day. There has been a change in fish population; some of the indigenous species have been drastically reduced in number, while some of the introduced species like Catla and Labeo calbasu have increased in the catches. The carnivore population of Macrones sp. and Wallagonia seem to have stabilized themselves. More fish probably could be exploited from the reservoir.--Copyright 1975, Biological Abstracts, Inc. W76-06020

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SOME HELMINTHS OF BULINUS TRUNCATUS AND BIOMPHALARIA ALEXANDRINA FROM THE IRRIGATION SYSTEM NEAR CAIRO, Ceskoslovenska Akademie Ved, Pra

Ceskoslovenska Ak Parazitologicky Ustav. For primary bibliographic entry see Field 5A. W76-06028

GLUCURONIDE FORMATION IN RAINBOW TROUT: EFFECT OF SALICYLAMIDE ON THE ACUTE TOXICITY, CONJUGATION AND EXCRETION OF 3-TRIFLUOROMETHYL-4-NITROPHENOL, Medical Coll. of Wisconsin, Milwaukee. Dept. of

Pharmacology.

John, J. Lech Biochem Pharmacol. Vol 23 No 17 p 2403-2410. 1974 Illus

Descriptors: *Toxicity, *Larvicides, *Lampreys, Trout, Rainbow trout, Phenols. Identifiers: Antidote-Drug, Excretion, Fluoromethyl, Glucuronide, Salicylamide, 3-trifluoromethyl-4-nitvophenol(TFM), TFM.

In rainbow trout, the selective sea lamprey larvicide, 3-trifluoromethyl-4-nitrophenol (TFM), was previously found to be conjugated with glucuronic acid and excreted to a great extent in bile. In order to determine the degree and significance of conjugation of TFM in trout, studies utilizing salicyla-mide, an inhibitor of glucuronide formation, were carried out. Pre-exposure of rainbow trout mg/1 of salicylamide decreased the LC50 of TFM from 5.05-2.67 mg/1. Coincidental with the increase in toxicity were elevated blood levels of un-conjugated TFM and a depression of TFM glucu-ronide in blood and bile. An increase in the level of unconjugated TFM was also found in brain, muscle and heart from salicylamide-treated trout. Salicylamide increased the half-life of i.p. injected TFM from 1.59-4.13 h and inhibited the glucuronidation of TFM by trout liver extracts in vitro. Glucuronide formation appears to be an important mechanism in the protection of trout from the toxic effects of TFM and possibly other water-borne phenols...Copyright 1975, Biological Abstracts, Inc. W76-06031

ON SOME PROBLEMS OF THE BIOLOGICAL CONTROL OF HUMAN SCHISTOSOMES IN

Ceskoslovenska Ak Parazitologicky Ustav. Akademie Ved, B. Rysavy, V. Barus, F. Moravec, and F. Yousif. Folia Parasitol (Prague). Vol 21 No 2 p 161-168

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Descriptors: *Trematodes, *Animal parcesites, Nitermediate hosts, Human diseases. Identifiers: Echinostomatidae, Egypt, Flukes, Human, Irrigation, Schistosomatidae,

The results of investigations of parasites of water-snails from the area of Warak El Arab, and of competitive interactions between larval stages of competitive interactions between larval stages of trematodes of the family Echinostomatidae and Schistosomatidae in the intermediate host are presented. The work was performed by a joint Czechoslovak-Egyptian team in 1971-1973. The results confirm earlier reports on the predation of the rediae of echinostome flukes upon schistosome sporocysts, and the pathogenic effect of the developmental stages of these flukes, including the metacercariae, on the snail intermediate host. An analysis was made of the possibilities of utilizing this knowledge for the biological control of human schistosomes in areas with a dense network of irrigation canals.--Copyright 1975, Biological Abstracts, Inc. W76-06034

EPIZOOTIOLOGY OF MINCHINIA NELSONI IN SUSCEPTIBLE WILD OYSTERS IN VIR-GINIA, 1959 TO 1971,

Virginia Inst. of Marine Science, Gloucester Point. J. D. Andrews, and M. Frierman.
J Invertebr Pathol. 24(2): 127-140, 1974.

Descriptors: *Virginia, *Oysters, Epizooliology, Animal parasites, Fish parasites, Chesapeake Bay,

Identifiers: *Minchinia-Nelsoni.

Twelve years after the haplosporidian parasite M. nelsoni erupted causing severe epizootics of oysters in lower Chesapeake Bay, regular patterns of mortalities and disease prevalence persisted. Distribution changed with salinity and weather patterns, but in mesohaline areas (about 15-25 P.P.T.) pressure remained high and relatively sta-ble despite scarcity of oysters. Susceptible dis-ease-free oysters from low-salinity areas of the James River, the major seed area in Virginia(USA), were transplanted annually to disease-prevalent areas for monitoring in trays. Mortalities were usually over 50% the 1st year and almost as high in the 2nd year. Prevalences of the pathogen, called MSX, ranged from 35-50% in live oysters. Seasonal patterns of disease activity are depicted from 1960-1971, and they exhibit exceptional regularity for open-water conditions. Source and history of oysters, and timing of exposure are important variables that affect disease activity as well as size and age. The disease caused by MSX appears to be not contagious in trays. The patterns of disease and mortality obtained from susceptible wild oysters without previous exposure provided a basis for evaluating other stocks including genetic strains selected for disease resistance.--Copyright 1975, Biological Abstracts, Inc.

A NOTE ON THE USE OF ALGAL SIZES IN ESTIMATES OF POPULATION STANDING

Victoria Univ. of Manchester (England). Pollution Research Unit For primary bibliographic entry see Field 5A.

W76-06043

MACROVEGETATION AND ECOLOGICAL FACTORS IN TWO NORWEGIAN LAKES, OSIO Univ. (Norway). Dept. of Limnology, and Oslo Univ. (Norway). Inst. of Marine Biology. K. A. Okland. Norw J Bot. 21(2): 137-159. 1974.

Descriptors: *Vegetation, *Lakes, *Ecological distribution, *Eutrophication, Organic matter, Humus, Water pollution effects, Production. Identifiers: Elodeids, *Norway.

Sukkevtn and Grennesvatn, 2 shallow, lowland lakes in Vestfold, South Norway, are moderately eutrophic, medium rich in lime, mostly slightly acid, with maximum Secchi disc transparency values of 2.7 m and 3.5 m, respectively. Sukkevatn is considerably influenced by humic matter. Macrovegetation (specially elodeids) is more luxuriantly developed in Grennesvatn than in Sukkevatn. It is suggested that a presumably smaller biomass and lower production of water plants in Sukkevatn may be attributed primarily to a negative effect of humic matter. Horizontal and vertical distribution of macrovegetation, floristic lake typology and regional aspects of floristic lake types in Norway are discussed.—Copyright 1974, Biological Abstracts, Inc. Sukkevtn and Grennesvatn, 2 shallow, lowland

STUDIES ON THE CA, MG, AND SR CONTENT OF FRESHWATER CLAMSHELLS, Texas Univ. at Dallas, Richardson.

For primary bibliographic entry see Field 2H. W76-06119

GENERIC COMPOSITION AND NUTRITIONAL REQUIREMENTS OF BACTERIA ISOLATED FROM THREE LAKES, Nicolas Copernicus Univ. of Torun (Poland). Lab. of Microbiology. For primary bibliographic entry see Field 2H.

W76-06120

MICROORGANISMS AND SULPHIDE IN A POLLUTED ESTUARY,

Canterbury Univ., Christchurch (New Zealand). Dept. of Botany. J. S. Waid.

Mauri Ora. 2, p 59-61, 1974.

Descriptors: *Estuaries, Estuarine environment, Bacteria, Microorganisms, Sulfides.

Some of the major roles of microorganisms (bacteria) in estuarine environments are described (bacteria) in establine civitoniments are described and, by considering the ways microorganisms transform S and its compounds, it is shown that microbial activities are influenced not only by what goes on in an estuary but also by events in its catchment area .-- Copyright 1975, Biological Abstracts. Inc. W76-06121

ION EXCHANGE TECHNIQUE FOR THE DETERMINATION OF CHLORINATED PHENOLS AND PHENOXY ACIDS IN ORGANIC TISSUE, SOIL, AND WATER,

National Swedish Environment Protection Board, Stockholm. Wallenberg-Lab. For primary bibliographic entry see Field 5A.

MICROBIOLOGICAL AND CHEMICAL EN-RICHMENT OF FRESHWATER-SURFACE MICROLAYERS RELATIVE TO THE BULK-

SUBSURFACE WATER, Virginia Univ., Charlottesville. Dept. of Biology. R. F. Hatcher, and B. C. Parker. Can J Microbiol. 20(7), p 1051-1057, 1974.

Descriptors: *Bacteria, *Fungi, Nitrates, Nitrites, Phosphates, Sulfates, Metals, Air-water inter-faces, Ecological distribution, Eutrophication, Sampling, Chemical properties, Biological proper-

Concentrations of bacteria, fungi, ammonium, nitrate, nitrite, orthophosphate, sulfate, and certain metals were enriched in freshwater-surface

microlayer samples relative to the bulk-subsurface water. Results differed markedly depending on which of 3 methods for surface microlayer collection was used. The biologically and chemically rich freshwater-surface microlayers contribute to ecological functions and interactions between subsurface water and the atmosphere not heretofore investigated in freshwater.--Copyright 1974, Biological Abstracts, Inc.

W76-06124

EMORY OAK (QUERCUS EMORYI) LITTER PHENOLICS AS ENVIRONMENTAL HAZARDS FOR AQUATIC ANIMALS IN SOUTHEASTERN

Colorado State Univ., Fort Collins. For primary bibliographic entry see Field 5B.

THE INFLUENCE OF DISSOLVED OXYGEN CONCENTRATIONS ON THREE SPECIES ON WATER MITES (HYDRACARINA), Southwest Texas State Univ., San Marcos. Dept. of Biology.

W. Young, and A. C. Rhodes. Am Midl Nat. 92(1), p 115-129, 1974.

Descriptors: Dissolved oxygen, *Mites, Miticides,

Insects, Insect control, Metabolism.
Identifiers: Hydracarina, Hydryphantes-Tenuabilis, Lactic acid, Lebertia-Quinquemaculosa, Limnesia-Undulata.

The influence of various concentrations of dissolved O2 on the metabolic rate, survival, accumulation of lactic acid and rate of movement of Hyd-ryphantes tenuabilis from a pond and Lebertia quinquemaculosa and Limnesia undulata from a constant-temperature spring run was investigated.
H. tenuabilis proved to be an O2 regulator which reached a maximum O2 consumption of 483 mm 3/g wet wt/h at about 30% O2 saturation. L. quinquemaculosa and L. undulata had maximum O2 consumptions of 568 and 732 mm 3/g wet wt/h, respectively, at the highest O2 concentration respectively, at the inglest of contentation tested, 5.8 mg/l and appear to be O2 conformers. H. tenuabilis showed a more variable and higher rate of survival at dissolved O2 concentrations less than 0.1 mg/1 than did either L. quinquemaculosa or L. undulata. None of the 3 spp. showed signifi-cant accumulation of lactic acid in reduced O2 concentrations. The rate of movement of L. quinquemaculosa was greatly influenced by the dissolved O2 concentration, with activity being reduced at low O2 levels; L. undulata was influenced to a lesser degree; and H. tenuabilis was virtually unaffected. The difference in responses of H. tenuabilis to various dissolved O2 concentrations as compared to L. undulata and L. quinquemaculosa may result from its evolution in ponds which experience radical changes in O2 concentrations as opposed to the more uniform conditions of streams inhabited by the other 2 spp.--Copyright 1974, Biological Abstracts, Inc. W76-06133

YEASTS ISOLATED FROM SOME LAKES AND RIVERS OF SASKATCHEWAN, National Research Council of Canada, Saskatoon

(Saskatchewan) Prairie Regional Lab. For primary bibliographic entry see Field 5B.

OUTBREAKS OF WATERBORNE DISEASE IN THE UNITED STATES, 1971-1972, Center for Disease Control, Atlanta, Ga. M. H. Merson, W. H. Barker, Jr., G. F. Craun, and

L. J. McCabe J Infect Dis. 129(5) p 614-615, 1974.

Descriptors: *Viruses, *Human diseases, *United States, *Bacteria, *Chemical wastes, Water pollution effects, Public health, Water supply. Identifiers: *Waterborne diseases.

Group 5C-Effects Of Pollution

A discussion of human disease in the USA due to contaminated water is presented. Diseases were caused by bacteria, viruses, and chemicals. Incidences from different types of water sources were compared. The discussion covers a 2 yr period. --Copyright 1974, Biological Abstracts, Inc. W76-06138

SEASONAL DYNAMICS AND PRODUCTIVITY OF TANYTARSUS BARBITARSIS FREEMAN (DIPTERA:CHIRONOMIDAE) IN THE BENTHOS OF A SHALLOW, SALINE LAKE, Mount Allison Univ., Sackville (New Brunswick). Dept. of Biology.

C. G. Paterson, and K. F. Walker. Aust J Mar Freshwater Res. 25(1), p 151-165, 1974.

Descriptors: Seasonal, *Productivity, *Diptera, Benthos, *Australia, *Saline lakes, Lakes, Water pollution effects.
Identifiers: Necterosoma-Penicillatum, Tanytar-

sus-Barbitarsis, *Victoria(Lake Werowarp), Shal-

The chironomid T. barbitarsis is the only abundant benthic species in Lake Werowrap, western Victoria (Australia), a small, shallow, highly alkaline lake in which high, fluctuating salinities (36-56 g/1) impose an extremely low biotic diversity. Between successive Octobers in 1969 and 1970, the chironomids passed through about 7 generations, attaining numerical densities in excess of 140,000/m2. Seasonal fluctuations in density were attributed to emergence, available food, and predation by a dytiscid, Necterosoma penicillatum, occurring in high densities around the rocky marginal areas of the lake. Estimated annual net production, exclusive of mortality and 1st and 2nd instar biomass, amounted to about 320 kcal/m2/yr. This is perhaps the highest estimate recorded for an inland aquatic macrobenthos community. Evidence from salinity tolerance experiments suggests that the lake is not an optimal environment for the species.--Copyright 1974, Biological Abstracts, Inc. W76-06142

DYNAMICS OF BENTHIC INVERTEBRATES IN TROPICAL MAN MADE LAKE (VOLTA AKE 1964-1968): STANDING CROP AND BATHYMETRIC DISTRIBUTION,

Monash Univ., Clayton (Australia). Dept. of Zoology T Petr

Arch Hydrobiol. 73(2), p 245-265, 1974.

Descriptors: Standing crops, Laks, Invertebrates, Benthic fauna, Diptera, Mayflies, Distribution patterns, Biomass, Dissolved oxygen, Africa. Identifiers: Nilodorum-Brevibucca, Povilla-Adusta, *Volta Lake(Ghana), Man-made Lakes.

During the 1st 5 yr of the filling of Volta Lake (in Ghana, West Africa) 2 major groups of invertebrates dominated the benthic fauna: ephemeronterans, especially the nymphs of Povilla adusta Navas, and chironomids, especially the larvae of Nilodorum brevibucca Freeman and Chironomus spp. Their later decline in numbers resulted in a decrease in the biomass of the benthic invertebrates in the lake. The quantitative and qualitative changes in the benthic fauna in this lake seem to be determined to a large extent by changes in the substratum due to shoreline erosion. lowering of the O2 discontinuity and the prolongation of periods of high dissolved O2 content in deep water helped the bottom fauna to occupy greater depths, but did not prevent the decrease in the total standing crop of benthic invertebrates in the lacustrine sector during the process of lake ageing. The major inflows are responsible for maintaining a high biomass of the bottom fauna in areas under their direct influence .-- Copyright Biological Abstracts, Inc.

PHYTOPLANKTON IN KINDER LAKE. OF IN KINJHAR LAKE, Univ. Karachi, Karachi, Pak. Dep. Zool., Karachi

Univ. (Pakistan). Dept. of Zoology. S Nazneen Pak J Bot. 6(1) p 69-82, 1974.

Descriptors: Phytoplankton, Seasonal, Ecological

Descriptors: Phytopiankton, Seasonai, Ecological distribution, Asia, Lakes, Eutrophication, Chlorophyta, Cyanophyta, Algae. Identifiers: Bacillariophyceae, Melosira-Granulata, Microcystis-Aeruginosa, *Pakistan(Kinjhar Lake), Spirogyra-Fuellebornei.

An ecological survey of phytoplankton in Kinjhar Lake (Pakistan) was carried out from March 1968 to Feb. 1971 at the surface and from March 1970 to Feb. 1971 at various depths. Phytoplankton belonging to Cyanophyceae (22 spp. belonging to 12 genera), Bacillariophyceae (53 spp. belonging to 27 genera) and Chlorphyceae (19 spp. belonging to 8 genera) were observed. Microcystis aeruginosa was the most abundant species present throughout the year at the surface, but its maximum growth was observed in summer. Melosira granulata and Spirogyra fuellebornei were next in abundance. Kinjhar Lake is highly eutrophic .-- Copyright 1974, Biological Abstracts, Inc. W76-06146

THE COMBINED EFFECTS OF HIGH SALINI-TY AND TEMPERATURE ON THE SURVIVAL OF YOUNG LIMANDA LIMANDA,

Leeds Univ. (England). Wellcome Marine Lab.

Mar Biol (Berl), 25(3), p 169-175, 1974.

Descriptors: Salinity, Temperature, Mortality, Fisheries, Water pollution effects, Model studies, Water pollution sources, Waste disposal. Identifiers: Limanda-Limanda, Dabs.

Young specimens of the most common inshore flatfish, the dab L. limanda, in the area of a proposed concentrated brine discharge, off the Yorkshire coast (England) were subjected to high salinities over temperatures corresponding to an annual temperature range. The results of th periments have been used in the design of a dilution and dispersion system to protect the inshore fisheries. Mortality is size-dependent, smaller dabs being least resistant. Response-surface analyses were utilized, showing mortality in rela-tion to immersion time. The effect of temperature slowly declines with increased immersion time and salinity becomes increasingly dominant. A significant salinity-temperature interaction was observed, which reached its peak effect at 3 h immersion. A 3-dimensional response-surface model of the mortality contours, for salinity, temperature and immersion time, was produced which may be used to set upper limits to the design of the effluent disposal system. If salinity does not rise above 55 re parts per thousand, it is unlikely that significant changes in the L. limanda populations will occur.--Copyright 1974, Biological Abstracts, Inc. W76-06148

5D. Waste Treatment Processes

URBAN STORM WATER POLLUTION, GKY and Associates, Alex., Va G. K. Young.

Water Resources Research, Vol. 12, No. 1, p 94-100, February 1976. 2 fig, 2 tab, 10 ref.

Descriptors: *Urban hydrology, *Storm water, *Water pollution control, *Methodology, *Water pollution control, *Methodology, *Sewers, Overflow, Decision making, Screening, Alternative planning, Treatment facilities, Equations, Systems analysis. Identifiers: Sensitivity analysis.

A novel and simple method of analysis of the urban combined sewer and overflow problem is developed. An aggregated method is presented which relates a few significant variables to produce a scalar that describes the severity of pollution for an urban area. Typical values of the variables are assigned, and sensitivity analysis of urban storm-induced pollution to various control measures is demonstrated. The method takes a macroanalytic perspective which should produce comparisons adaptable to decision rules for funding priorities. Work on specific cities is necessary to refine the approach and rank alternatives. The method should screen out poor candidates for funds early in the decision-making process and concentrate feasibility studies and analysis upon needy sites and viable alternatives. It is concluded that: (1) the method has utility for first-level screening of alternatives at the national or state decision-making level; (2) the hydrologic variables do not enter into the assessment of the maximum pollutional impacts of storms; (3) a relatively small set of variables, several relating to water use and the sewer treatment system and the other defining the quality of receiving waters, storm wash and raw sewage are used to conduct the analysis employing the simplified method; and (4) the maximum storm-induced water quality is several times the water quality associated with the dry weather engineering design limits of sewage treatment per-formance. (Bell-Cornell) W76-05509

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METHOD OF BIOLOGICAL PURIFICATION OF SEWAGE.

Degremont Societe Generale d'Epuration et d'Assainissement, Rueil-Malmaison (Assignee). J. L. Bebin.

U. S. Patent No. 3, 928,190, 5 p, 4 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1781, December 23, 1975.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water purification, Water polcontrol, Water quality control, Floccula-Filtration, Aeration, Aerobic conditions, *Biological treatment. Identifiers: Biologic filters.

Methods of purifying sewage containing a strong organic pollution comprises two successive stages. The first, a flocculation stage is performed by using non-toxic and non-bacteriostatic reagents selected from the group consisting of aluminium salts and iron salts. The immersed biological filtra-tion stage is performed on a filter bed formed of a porous mass of granular material having smooth zones on the surfaces capable of supporting bac-terial film and limited hollow zones capable of supporting bacterial film and retaining such film even when the filter is subjected to severe backwashing. The granular material is formed by burning clay with dextrin approximately 900 dec C. The backwashing of the filter removes bacterial film from the smooth zones while bacterial film remain in limited zones and the wash water is recycled into the waste water at a position upstream of the flocculation stage thus producing a permanent reseeding of the sewage and maintaining the biological equilibrium of the filtering mass. (Sinha -OEIS) W76-05524

BIODEGRADATION OF METHANOLIC

WASTE WATER, Du Pont de Nemours (E. I.) and Co., Wilmington, Del. (Assignee).

I. J. Belasco.

U. S. Patent No. 3,928,191, 4 p, 7 tab, 7 ref; Official Gazette of the United States Patent Office Vol 941, No 4, p 1781, December 23, 1975.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Water quality control, Water pollution control,

*Biodegradation, Methane bacteria, Aerated lagoons, Montmorillonite.
Identifiers: *Methanolic waste water.

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The rate of microbial biodegradation of methanolic waste water can be accelerated by carrying out the biodegradation in the presence of dispersed, particulate attapulgite or montmorillonite clay. Microbes suitable for this type of biodegradation Microbes suitable for this type of biodegradation are abundant in river water, soil, activated sludge, and raw sewage. By methanolic waste water is meant water having an organic content of 0.01 to 10% (preferably 0.05 to 5%) by weight, at least 80% of which is methanol. The waste water can contain as much as 2% by weight KC1 and other inorganic salts. The process is carried out at a pH in the range of about 6 to 8 (preferably 6.5 to 7.5) and temperature in the range of about 5 deg to 38 deg C. () The average particle size of the clay is in the range of about 0.5 to 40 microns and the clay concentration is in the range of about 10 to 10,000 ppm. The process can be carried out in a biological reactor or aerated lagoon. The clay is maintained in suspension by appropriate agitation from stirring devices or aeralagoon. The clay is maintained in suspension by appropriate agitation from stirring devices or aerators. The pH can be maintained by addition of alkalkaline's such as ammonia, calcium oxide, caustic, or lime, or by use of a buffer. (Sinha-OEIS) W76-05525

BUFFERED, WEAK ION-EXCHANGE WATER DEMINERALIZATION PROCESS, Aerojet-General Corp., El Monte, Calif. For primary bibliographic entry see Field 3A. W76-05526

LIQUID PURIFYING PROCESS, Kelmik, Inc., East Lansing, Mich. (Assignee).
J. B. Hoeltgen, and H. E. B. Humphrey.
U.S. Patent No. 3,928,195, 8 p, 8 tab, 6 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1782, December 23, 1975.

Descriptors: *Patents, *Waste water treatment, Water quality control, Water pollution treatment, Suspended solids, *Sludge, Chemical reactions, *Filtration, Farm wastes, Domestic wastes, Heavy metals.

Identifiers: *Metal recovery.

The process comprises sequentially introducing a soluble alkali aluminate such as sodium aluminate, a soluble alkali silicate such as sodium silicate, and a soluble ammonium ion source or a soluble di- or trivalent cation source, preferably a soluble di- or trivalent metal salt such as calcium chloride, with agitation into the liquid system to be treated. The resulting complex of the recovered solids is then separated from the liquid by filtration. The essence of the process is a sequential reaction between the three chemicals in the environment of the system being treated which produces a com-plex which entraps or complexes with the suspended solids and even some solutes and which suspended solids and even some solutes and which is readily separated by filtration. The process is suitable for purifying a variety of liquid systems, including aqueous and certain organic liquid systems. The process is believed to be effective for purifying any kind of waste waters with very low to very high waste concentrations and very high settleable solids concentrations, e.g. between 1 and about 900,000+ ppm settleable solids. The process yields a highly dewatered complex of recovered solids which can be safely stored, handled, and beneficially used. (Sinha-OEIS) dled, and beneficially used. (Sinha-OEIS) W76-05528

INHIBITION OF SCALE DEPOSITION,

Calgon Corp., Pittsburgh, Pa. (Assignee). L. J. Persinski, P. H. Ralston, and R. C. Gordon,

U.S. Patent No. 3,928,196, 3 p, 2 tab, 1 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1782, December 23, 1975.

Descriptors: *Patents, *Waste water treatment, *Scaling, *Inhibition, *Inhibitors, *Hardness(Water), Demineralization, Industrial water, Damages, Chemical precipitation, Chemical reactions.

Identifiers: Industrial water systems.

Most industrial waters contain alkaline earth metal cations and several anions. When combinations of cations and several amons. When combinations of these anions and cations are present in concentra-tions which exceed the solubility of their reaction products, precipitates form. Solubility product concentrations are exceeded for various reasons, such as partial evaporation of the water phase, change in pH, pressure or temperature, and the introduction of additional ions which form insoluble compounds with the ions already present in the solution. As these reaction products precipitate on surfaces of the water carrying system, they form scale or deposits. This accumulation prevents effective heat transfer, interferes with fluid flow, fective heat transfer, interferes with fluid flow, facilitates corrosive processes, and harbors bacteria. Copolymers of 2-acrylamido-2-methylpropyl sulfonic acid and acrylic acid are effective in inhibiting scale formation and deposition in aqueous systems. These copolymers may have a molecular weight of from about 1000 to 100,000 and may contain from about 5% to 75mole% 2-acrylamido-2-methylpropyl sulfonic acid and from about 95 to 25 mole% acrylic acid. Experiments at several temmole% acrylic acid. Experiments at several temperatures for various lengths of time demonstrate the effectiveness of different concentrations and forms of these combinations in inhibiting the precipitation of scale-forming salts. (Sinha-OEIS) W76-05529

BIO POND AERATOR,

U.S. Patent No. 3,928,512, 3 p, 2 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1865, December 23, 1975.

Descriptors: *Patents, *Waste water treatment, *Water treatment, Water pollution treatment, Water quality control, *Aeration, Mixing, Aerated lagoons, Water circulation, Application equip-

A device is described which is used in aerating and mixing the liquid in conventional water and waste water treatment facilities. A tube extending above the liquid surface and below the surface to a predetermined depth contains an impellor on a shaft connected to a motor. A float ring, attached around the tube, is sufficiently buoyant to float the entire device and the effective weight of liquid in the tube while operating. Aerator arms are provided with a float on one end and a hinge atvided with a float on one end and a hinge attachment to the tube. Overflow weirs allow liquid
raised by the impellor to flow onto the aerator
arms. The arms provide spillage of liquid by means
of holes in their lower surfaces. Two or more paddle-like structures are mounted on the tube below
the liquid surface. When the impellor is turned the
liquid rises in the tube causing it to spin and mix
the liquid by means of the paddles. The same
torque causes the arms to move in a circular path
over the surface. As the liquid raised by the impelover the surface. As the liquid raised by the impellor flows over the weirs onto the aerator arms, it is pulled by gravity toward the float end of the arms. Holes in the arms lower surface allows liquid to fall and impact upon the liquid surface resulting in aeration. (Sinha-OEIS) W76-05535

LEACHING POLYELECTROLYTE FLUIDIZED SOLIDS,

American Cyanamid Co., Stamford, Conn. (Assignee) R. B. Booth

U. S. Patent No. 3,928,551, 12 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1876, December 23, 1975.

Descriptors: *Patents, *Waste water treatment, Suspended solids, Solid wastes, Flow control,

Aqueous solutions, Industrial water, Polymers, *Polyelectrolytes, *Leaching. Identifiers: Resuspension.

The fluidizing of finely-divided solids particularly those containing a broad range of particle sizes, during acid leaching and related operations by the use of a water-soluble polyelectrolyte is described. The process is applicable in maintaining the fluidity of suspensions of sand, silt or dredged materity of suspensions of sand, salt or dredged materials, and maintaining solids in resuspendable forms. The presence of a polymer of the acrylamideacrylic acid-acrylonitrile type causes the fines to remain with the large particles and settle out comparatively homogeneously. This aids in preventing deposits of coarse materials in settling tanks, leach tanks, internal combustion engines and their radia-tors, heat exchangers, cooling towers, flowing streams in natural or man-made water courses, and mine operations, and the polymer in solution can penetrate into coarse material with fines so that settled material can be resuspended. Some times preexisting deposits are loosened and resuspended along with the solids maintained in fluidized state. Such deposits are particularly predominant in sewage lines including sanitary, storm and industrial lines and in circulating water lines. The polyelectrolyte may be added at any point in the processing. Additional quantities of the same or different polyelectolyte may be added to assist in a subsequent dewatering operation. Suitable polymers are polyacrylic and polyacryla-mide, hydrolized polyacrylonitrile, and alkali-hydrolyzed, polyacrylamide, and acrylic acid-acrylamide copolymers. (Sinha - OEIS) W76-05536

PROCESS FOR BIOCHEMICAL REACTIONS, Gary Aircraft Corp. San Antonio, Tex. (Assignee). P. E. Smith.

U. S. Patent No. 3,929,630, 6 p, 7 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2232, December 30, 1975

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Sewage treatment, Water pollution treatment, Aerobic conditions, Anaerobic conditions, Biodegradation, Filtration, Oxydation, Biochemical Oxygen Demand, Trickling Filters. Identifiers: *Biochemical reactions.

A biochemical reaction is carried out by introducing the reactants to the surface of a rigid, porous and adsorbent silican foam substrate which has been coated with an organic polymer prior to the introduction of the reactants. Biochemical reactions include the treatment of sewage, treatment of liquid effluent such as waste water, and fermentation of carbohydrate liquids. The reactions may be aerobic, anaerobic or facultative. The trickle filter may be of conventional design structurally except that the filter media or substrate is prepared from an inorganic foamed material. The vessel or enclosure is provided with means for introducing the liquid such as a pipe and spray head so that the liquid is passed through the filter media. Oxygen is introduced by any suitable means. The inorganic foam providing higher surface areas allows for a longer holding time for nutrients on the surface and allows for greater throughput. The silica foam substrate also exhibits greater capillary ing the reactants to the surface of a rigid, porous ica foam substrate also exhibits greater capillary action characteristics with the consequent advantage that the substrates do not dry as rapidly during periods of non-use. (Sinha - OEIS) W76-05542

METHOD AND APPARATUS FOR CENTRIFU-GALLY SEPARATING FINELY DIVIDED SOLIDS FROM AQUEOUS SUSPENSIONS

THEREOF, Canadian Patents and Development Ltd., Ottawa

Canadian Patents and Development Law, Contariol. (Assignee).
J. Visman, and H. A. Hamza.
U.S. Patent No. 3,929,633, 7 p, 4 fig, 7 tab, 2 ref;
Official Gazette of the United States Patent Office, Vol 941, No 5, p 2232, December 30, 1975.

Group 5D—Waste Treatment Processes

Descriptors: *Patents, *Industrial wastes, *Waste water treatment, Water pollution control, Effluents, Water quality, *Suspended solids, *Separation techniques, Flocculation, *Centrifugation, Application equipment.

A method and apparatus is provided for centrifugally separating finely divided solids from aqueous suspensions by forming dense, strong flocs which are larger than the 'size cutpount' of a cyclone separator so that the flocs can be separated. A flowing sheet of the aqueous suspension is formed into a swirling cone in a blender. A solution of a water soluble high molecular weight, long chain flocculant is sprayed at right angles into the side face of the flowing sheet so that the flocculant is absorbed into the wetted surfaces of the finely di-vided solids. Floc strength is achieved by rapidly dispersing the flocculant in suspension in such a way as to promote maximum bridging rather than excessive adsorption. Floc size is determined by flocculant dosage. Dosage in two or more stages increases floc density and floc strength. The flocs are then centrifugaly selparated by a cyclone separator. (Sinha - OEIS) W76-05543

USE OF POLYMERIC QUATERNARY AM-MONIUM BETAINES AS WATER CLARIFIERS, Petrolite Corp., St. Louis, Mo. (Assignee). For primary bibliographic entry see Field 5F.

PROCESS FOR CONDITIONING EFFLUENT CONTAMINATED BY ALDEHYDE COMPOUNDS.

Air Liguidel Societe Anonyme pour l'Etude et l'Exploitation des Procedes, Paris (France). (Assignee).

J. P. Žumbrunn. U. S. Patent No. 3,929,636, 4 p, 1 tab, 9 ref; Official Gazette of the United States Patent Office, Vol941, No 5, p 2233, December 30, 1975.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, Effluents, Water pollution control, Water pollution treatment, Water quality control, Oxidation, Chemical reaction, Toxins, Chemicals.

Identifiers: Aldehydes, Formaldehyde, Caro's

The invention describes an industrially applicable process which provides rapid, complete and economic detoxification of effluent contaminated by aldehyde impurities. The process comprises oxidizing the impurities with a peroxy compound containing the anion SO5--, the preferred peroxy being either Caro's acid, H2S05, as an aqueous solution of the free acid, or a salt of Caro's acid. The treatment can take place at ambient temperature and the oxidant can be mixed with the effluent at a neutral or moderately alkaline pH which is preferably at least 9 and most preferably is between about 9 and about 10. The treatment time depends on the pH, the reaction time being determined mainly by the pH since breakdown of the formaldehyde proceeds more rapidly as the pH is more alkaline. The oxidant can be introuced all at once or in two or more stages. (Sinha-OEIS)

FILTERING APPARATUS AND PROCESS, Gaston County Dyeing Machine Co. Mount Holly, N. C. (Assignee).

J. K. Turner, and G. L. Parsons. U.S. Patent No. 3,929,639, 4 p, 5 fig, 19 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2234, December 30, 1975.

Descriptors: "Patents, "Waste water treatment, *Industrial wastes, Water pollution treatment, *Filtration, Water conservation, Water reuse, Textiles, Fibers(Plant), "Recycling, Identifiers: Lint, Filter regeneration. The lint content of wash water effluent, particularly from textile wet processing operations, has previously hampered attempts at recycling because of the difficulty inherent in removing the lint effectively enough in a practical way to condition the water satisfactorily for reuse. A filter system is disclosed in which circulation of the liquid to be filtered is such that a predominant por-tion is continually returned through the filter unit to produce a filtered permeate amounting to 70% or more of the feed while also tending to clear the filter media continually. Depending on the particu-lar condition of the liquid being handled, the filter system can be used effectively in single unit form with periodic regeneration being employed, as necessary, to maintain the filtering function, or a multiple unit arrangement is provided in which one unit of the multiple, in sequence, is always regenerating while the others are operating and a continuous output is maintained in this way.
Regeneration of the filter units is effected by closing them against filtered permeate output so that the filter media is subjected to the cleansing action of liquid circulation only at its active face. The filter media is provided in elongate cartridge form and placed within a cylindrical housing to leave an annular circulation space to which the liquid to be filtered is delivered tangentially at points spaced lengthwise of the elongate cartridge. (Sinha -W76-05546

WATER TREATING APPARATUS, Ecodyne Corp., Chicago, Ill. (Assignee). For primary bibliographic entry see Field 5F. W76-05547

PROCESS FOR TREATING WASTE WATER CONTAINING CELLULOSE NITRATE PARTICLES.

Office of the Secretary of the Army, Washington, D. C. (Assignee).
T. M. Wendt, and A. M. Kaplan.

M. Wendt, and A. M. Kaplan.
 United States Patent 3,939,068. Issued February
 17, 1976. Official Gazette of the United States
 Patent Office, Vol. 943, No. 3, p 1343, February,

Descriptors: *Waste water treatment, *Industrial wastes, *Chemical wastes, *Patents, Biodegradation, Chemical degradation, Chemical reactions. Identifiers: *Nitrocellulose nitrate wastes.

A process for the treatment of a waste stream from nitrocellulose manufacture containing at least 50 ppm of insoluble, non-biodegradable nitrocellulose material has been patented. The insoluble material is chemically digested by reacting it with alkali at a pH of at least 11.5. This converts the insoluble material to soluble and biodegradable organic and nitrate products. After chemical digestion, the waste stream is neutralized to a pH between 6.0 and 9.0. The neutralized waste stream is combined with domestic raw sewage and a microbially utilizable carbon material to form a mixed liquor. The mixed liquor is microbially denitrified, converting the nitrate content to nitrogen gas. The solids are separated from the liquor which is then subjected to aerobic biological treatment, degrading the organic products and converting reduced nitrogen compounds to nitrates. The effluent from the aerobic treatment is then denitrified. The process will produce a sub-stantially nitrate-free effluent with an acceptable BOD level. (Orr-FIRL) W76-05575

QUALITY AND VARIATION OF POLLUTANT LOADS IN URBAN STORMWATER RUNOFF, Windsor Univ. (Ontario). Dept. of Civil Engineer-

ing. For primary bibliographic entry see Field 5B. W76-05576 WATER CLARIFICATION SETTLER. For primary bibliographic entry see Field 5F. W76-05578 De

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WASTEWATER TREATMENT, Autotrol Corp., Milwaukee, Wis. (Assignee). W. N. Torpey. United States Patent 3,915,854. Issued October 28, 1975. Official Gazette of the United States Patent Office, Vol. 939, No. 4, p 2090, October, 1975. 1

Descriptors: *Waste water treatment, *Patents, *Biological treatment, *Oxidation, Equipment, Suspended solids, Ammonia, Nitrogen, Biochemical oxygen demand.

A patented method for treating waste water containing carbonaceous pollutants, expressed in terms of BOD and ammonia nitrogen in a weight ratio of at least 3.6:1 is described. Steps include removing settleable and flotable solids from the waste water; supplying the waste water to a hold-ing tank and storing it there; passing the waste water at a predetermined rate from the holding tank to a biological treatment unit; and directing the biologically treated waste water to a final clari-fier. In the clarifier, where suspended solids are removed, biological treatment includes not more than a single rotatable shaft supporting several partially submerged biological contactors. These have a surface area for the growth and maintenance of organisms, and create a flow of waste water through the biological treatment unit in a direction generally perpendicular to the rotatable shaft. The shaft is rotated to impart a predetermined peripheral velocity to the biological contactors, alternately exposing the surface area to waste water and an oxygen-containing atmosphere. The rate and peripheral velocity are chosen to simultaneously oxidize at least 83 weight percent of the BOD and at least 46 weight percent of the ammonia nitrogen. (Kramer-FIRL)
W76-05579

WASTE WATER AND SEWAGE TREATMENT. French Patent FR 2256-902. Issued September 1, 1975. Derwent French Patents Abstracts, Vol. W, No. 43, p D3, December 2, 1975.

Descriptors: *Waste water treatment, *Sewage treatment, *Biological treatment, *Activated sludge, *Dissolved oxygen, *Patents, Acration, Sludge treatment, Oxygen, Biodegradation.

A method of waste water and sewage treatment using dissolved oxygen and activated sludge has been patented. Wastes containing biodegradable impurities are treated in one or more enclosures. The contacts between the waste water, the activated sludge, and the dissolved oxygen are intensified by increasing the number of interfaces and by shortening the diffusion paths in the sludge floccules. This is accomplished by injectors, used with a liquid nozzle, an annular, concentric nozzle for the gas, and an impulse exchange tube. A liquid jet leaves the nozzle at a speed of 29 m/sec and sets up a shear gradient in the activated sludge. The air bubbles are finely divided and the sludge is simultaneously sucked into the zone of the jet and intensely mixed in the tube. Sludge leaving the tube is saturated with oxygen; gases within the sludge cause it to rise in the form of a bubbling column to the surface of the activated sludge. The quantity of sludge which can be treated per unit of volume per day is twice that of a conventional biological treatment facility. (Kramer-FIRL)

SUBMERGED AIR RELEASE DEVICE PAR-TICULARLY FOR SEWAGE TREATMENT, Envirex, Inc., Waukesha, Wis. (Assignee).

J. I. Moloney. United States Patent 3,915,862. Issued October 28, 1975. Official Gazette of the United States Patent Office, Vol 939, No 4, p 2093, October, 1975. I fig. Descriptors: *Waste water treatment, *Sewage treatment, Aeration, *Patents, Equipment, Biological treatment, Slime.

Identifiers: Air diffusers, Air release device.

A patent has been issued for a submerged horizontal air supply header which operates in combination with a sewage aeration tank. This release device discharges air from spaced orifices arranged within the tank in a line such that rising air bubbles induce a general rolling motion of the sewage. The sewage liquid is swept across the floor of the tank toward the header, where several air diffuser devices are attached. Each diffuser comprises a box-like structure including a top, side, and end walls forming a chamber which opens downwardly and has a number of orifices near its top. In normal operation, the lower part of the chamber is partially filled with sewage up to the hydrostatic pressure level of the air supply but below the orifices. The entire lower end of the diffuser is open and of substantial horizontal length. A patent has been issued for a submerged horizonfuser is open and of substantial horizontal length. The sweep of the sewage toward the header, therefore, extends to the air-sewage interface in the diffuser chamber and prevents the accumulation of biological slime. (Kramer-FIRL)

W76-05581

SEWAGE TREATMENT,

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United States Patent 3,915,853. Issued October 28, 1975. Official Gazette of the United States Patent Office, Vol 939, No 4, p 2090, October, 1975.

Descriptors: *Patents, *Sewage treatment, *Organic compounds, *Inorganic compounds, *Bacteria, Metals, Biological treatment, Chemical precipitation, Acidity, Alkalinity, *Waste water

A method has been patented for the treatment of liquid sewage containing both organic and inorganic compounds. These may include: a precipitable metal or metals; a compound containing any combination of starches, proteins, glycerides, and sugars; and pathogenic or other bacteria. The process involves adding to the sewage one or more alkaline compounds elected from the group of al-kali metal carbonate, alkali metal bicarbonate, and alkali metal hydroxide to precipiate out the metals as insoluble carbonates, bicarbonates, hydroxides, or oxides. These precipitated materials are removed from the rest of the liquid, adding enough alkaline material to the sewage to raise the pH to over 11, thus destroying pathogenic and other bacteria in the sewage. Enzymes are released from the teria in the sewage. Enzymes are released from the bacteria into the solution, lowering the pH of the sewage to between 3.5 and 6.5 by the addition of an acidic material. Any materials from the group consisting of starches, proteins, glycerides, and sugars are therefore enzymatically digested by the enzymes released. Seed bacterial, fungal or yeast organisms are then added to the sewage and assist in decomposing organic components. The sewage is acidified after substantial decomposition to kill the organisms developed from those seeded, dead the organisms developed from those seeded; dead organisms and other insoluble materials present are removed and the remaining liquid is neutralized. (Kramer-FIRL) W76-05582

WASTEWATER CARBON TREATMENT PROCESS.

Public Works, Vol 107, No 2, p 62-63, February, 1976. 1 fig.

Descriptors: *Sewage sludge, *Recycling, *Waste water treatment, *Sewage treatment, *Activated carbon, Dewatering, Separation techniques, Water quality control, Pilot plants. Identifiers: Pyrolysis.

A method has been developed for the recycle of sewage sludge, in which the solids are upgraded in value by processing to an activated carbon, which is then used to purify the water from which they were removed. In a pilot plant test, sludge solids were effectively extracted and dewatered without the aid of coagulants. The solids were converted to an activated carbon in a pyrolysis reactor and showed removal characteristics equal to or better than commerical carbons. The newlyproduced carbon could then be used to promote separation of settleable and suspended solids from the sewage and to remove dissolved solids from the water. The potential of this system to meet or exceed both federal and state requiremets for water disposal quality was also demonstrated. (Kramer-FIRL). W76-05583

CATHODIC INNER AND OUTER PROTECTION FOR A DOUBLE SYPHON FOR WASTE WATER (KATHODISCHER INNEN-UND AUS-SENSCHUTZ FUER EINEN ABWASSER-DOP-

PELDUEKER), F. Paulekat, and H. Schapp. Die Bautechnik, Vol. 52, No. 9, p 305-311, September, 1975. 16 fig, 6 ref.

Descriptors: *Siphons, *Municipal wastes, *Waste water treatment, Pipes, Plastics, Cathodic protection, Anodes, Installation, Insulation. Identifiers: Germany.

A new double waste water siphon installed un-derneath the Rhine-Herne Channel in West German, and its cathodic inner and outer protection are described. The municipal waste water siphon, replacing the old one destroyed by corrosion, has inner cathodic protection by means of foreign current, using a continuous anode near the pipe wall and attached to the latter with opposite electrodes on the pipe wall. Outer protection is accomplished by means of two Fe/Si anodes at a 70 m distance. The inner anode is protected by a plastic tube. The experience gained with the construction of the cathodically protected siphon shows that insulation should follow installation. (Takacs-FIRL) W76-05584

CHEMICAL PRECIPITATION OF WASTE-WATERS WITH LIME (KEMISK FALLNING AV AVLOPPSVATTEN MED KALK),

S. Gronkvist, B. Hultman, S. Kapilashrami, and P.

Kemisk Tidskrift, Vol. 87, No. 7/8, p 46-48, August, 1975. 3 fig, 1 tab, 19 ref.

Descriptors: *Waste water treatment, *Chemical precipitation, *Lime, Sludge treatment, Activated sludge, Filtration. Identifiers: Pho-Strip Process.

Different methods for the precipitation of waste water components with lime are discussed with respect to improved efficiency and reduced lime expenditure. The recirculation of purified water, the precipitation of calcium phosphate compounds on a solid carrier material, such as apatite or sand, and the addition of calcium and fluoride ions are among the basic possibilities to reduce the lime expenditure for precipitation. Very low lime doses of 20 to 24 mg calcium per liter can be used for Bio-spherics' Pho-Strip Process', in which precipita-tion takes place in the return sludge stream. Substantial reduction of the lime dosage may be achieved by a combination of this method and the passage of the entire purified water from the activated sludge process through a filter or apatite bed. (Takacs-FIRL)

NEW SYSTEM PUTS THE WOOD TO WASTE-WATER,

Kirkham Michael and Associates, Omaha, Nebr. C. L. Weber, and C. D. Jacobson. Water and Wastes Engineering, Vol. 12 No. 12, p 51-52, 64, December, 1975. 1 fig.

Descriptors: *Waste water treatment, *Activated sludge, *Treatment facilities, Food processing industry, Municipal wastes, Nebraska, Costs, Biochemical oxygen demand, Suspended solids, Filters, Filtration. Identifiers: *Municipal-industrial waste treatment,

Joint treatment.

Redwood media roughing filters and a completely mixed activated sludge system are part of the new secondary waste water treatment plant servicing two meat processing industries and the municipal population in Fremont, Nebraska. The joint treat-ment plant utilizes all the existing facilities of a treatment plant built in 1965. Designed for an average hydraulic load of 10.5 mgd per day, the facilities can treat an organic load of 37,000 pounds per day of BOD and 25,500 pounds per day of suspended solids. In addition, the plant was designed to handle a load of 14,100 pounds of grease per day. A dissolved air flotation system was installed for grease removal prior to primary clarification. To handle the high strength organic waste, the redwood roughing trickling filters were designed to precede the completely mixed activated sludge system. The roughing filters are designed to achieved 50% BOD reduction without recirculation. Other major treatment processes at the plant include pre- and post-chlorination facili-ties for odor control and disinfection. The con-struction costs of the secondary treatment plant improvements and modifications were \$2.6 million, 80% of which were financed by state and federal grants. After three months of full scale operation, the results are the following: the operation, the results are the following: the monthly average flow to the plant is 4.0 mgd with an average strength of 675 mg/liter of BOD; suspended solids in the raw flow are averaging 475 mg/liter while the grease concentration is 260 mg/liter; final effluent discharged from the plant is currently averaging 15 mg/liter of BOD and suspended solids; and grease concentration in the final effluent has averaged less than 10 mg/liter. (Loustau-Firl) W76-05586

ALIGNMENT OF LONGITUDINALLY AERAT-ING AERATION TANKS (NALADKA AEROTANKOV PRODLENNOY AERATSII),

G. G. Ryazanskiy, and A. D. Lerner. Vodosnabzhenie i Sanitarnaya Tekhnika, No. 6, p

Descriptors: *Aeration, *Tanks, *Waste water treatment, *Construction materials, Equipment, Identifiers: Soviet Union.

Criticism has been given of longitudinally aerating aeration tanks manufactured currently in the Soviet Union. The inlet grid mesh should be reduced from 10 x 10 mm to at least 5 x 5 mm to prevent large floating pieces from entering the aeration, and hence the return sludge. Also, the aeration intensity should be highest in the inlet section rather than at the outlet section. Aeration tank designs should not be chosen without regard to the climatic conditions under which they are to be operated. In particular, exposed metallic tanks are unsuitable for subarctic and arctic regions. (Takacs-FIRL) W76-05587

CONVERSION OF A TRICKLING FILTER PLANT TO ACTIVATED SLUDGE, Clapsaddle-Garber, Marshalltown, Iowa. D. M. Fox.

Public Works, Vol. 107, No. 1, p 48-49, January, 1976

Descriptors: *Waste water treatment, *Treatment facilities, *Activated sludge, Construction costs, Water quality standards, Repairing, Aeration. Identifiers: Facilities renovation, Trickling filter

Group 5D—Waste Treatment Processes

A deteriorating waste water treatment plant that had been built in 1937 was redesigned and renovated in order to meet EPA effluent quality standards. The existing structure was a typical plant having primary settling, trickling filter, final settling, a heated anaerobic digester, and sludge drying beds. The plant was subject to flooding from the Iowa River 200 feet away. In order to meet the new standards it was necessary for the plant to produce an effluent BOD of 30 mg/liter, suspended solids of 30 mg/liter, and bacteria colony count of 200 per 100 ml. To renovate the plant, the trickling filter distributor and rock were removed from the 89-foot diameter filter structure and the structure was rebuilt to accommodate the installation of concentric aeration and final settling chambers, the outer annular chamber serving for aeration. The traveling bridge which spans the structure supports two Passavant horizontal axis rotor surface aerators which operate in the outer ring of the baasin. The old final clarifier was remodeled to serve as a detention tank for chlorination and the digester was modified to funcchiorination and the digester was modified to func-tion as an open sludge storage tank and sludge thickener. The waste sludge is thickened and pumped to a tank wagon drawoff or to the sludge drying beds which were rehabilitated. Use of existing structures to the maximum possible extent contributed to the low cost of \$302,000 for construction, materials, and site dewatering. The plant produces an effluent suitable for discharge to a river utilized for potable water supply downstream. (Loustau-FIRL) W76-05588

REMOVAL OF AMMONIA NITROGEN BY CATALYTIC OXIDATION FILTER BED (SESSHOKU SANKA ROSHO NI YORU AMMONIA-SET CHISSO NO JOKYO),

S. Iwai, K. Kitao, and S. Tejima. Preprint, Japan Society of Civil Engineers, Tokyo, p 526-527, 1975. 6 fig, 2 tab, 3 ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Activated sludge, *Simulation analysis, Oxidation, Biological treatment, Ammonia, *Nitrogen, Dissolved oxygen, Organic compounds, Nitrification.
Identifiers: Starches, *Ammonia nitrogen.

The removal of ammonia nitrogen by activated sludge was studied using a simulation of sewage water containing 50 mg/liter CaCl2, 61 mg/liter MgSO4, 113 mg/liter KH2PO4, 252 mg/liter K2CO3, and various NH4Cl concentrations. Ac-tivated sludge was placed in a filtration bath. Experiments were performed using both flowing and non-flowing sewage systems, and the ammonium concentrations were measured. The reduction of ammonia nitrogen concentration in the system occurs in two ways: diffusional migration of ammonia nitrogen into the floc, and biological oxidation. The effect of the oxidation rate was examined for the solution pH, dissolved oxygen (DO), organic compounds concentration, and ammonium concentration. The suitable solution pH to give the peak oxidation rate was 7 to 8. The effect of DO concentration was clearly observed even at high DO concentrations, and the oxidation rate increased approximately parabolically with the DO concentration up to 5 mg/liter. The presence of starch in the simulated sewage con-taining 15 ppm ammonia nitrogen did not have any major effect on the oxidation rate. The removal rates were 0.149, 0.094, and 0.124 mg NH3-N/liter hr with the presence of starch concentration of 30, 170, and 200 ppm, respectively. Therefore, the presence of organic compounds could not be considered as a major inhibitory factor for biological nitrification. (Katayama-FIRL) W76-05589

BIOMASS DISTRIBUTION AND KINETICS OF BAFFLED LAGOONS,

Utah State Univ., Logan.
J. H. Reynolds, S. B. Nielson, and E. J.
Middlebrooks.

Journal of the Environmental Engineering Division Proceedings of ASCE, Vol. 101, No. EE6, p 1005-1024, December, 1975. 6 fig, 9 tab, 25 ref.

Descriptors: *Kinetics, *Lagoons, Model studis, *Biological treatment, Biodegradation, Monitoring, Suspended solids, *Wastewater treatment, Biomass, Distribution.

Identifiers: *Biomass distributions, Baffled waste stabilization ponds.

Performance, biological responses, and kinetics of three baffled model waste stabilization ponds were compared to those of an unbaffled model waste stabilization pond to determine the effects of baf-fle configurations and increasing submerged surface area. Three kinetic models were developed: a first-order completely mixed flow model, a model with materials balances and completely mixed flow, and a first-order growth model with a plug-flow reactor configuration. The submerged sur-face areas of the baffled ponds were equal and the environmental factors affecting pond performance were identical for all ponds. The ponds were illu-minated with fluorescent lights and fed a synthetic waste. Performance and biological responses were monitored during several different detention times. Results of monitoring and analyses of the ponds' various elements are given in tables and graphs. A dense layer of scum on the surface of the model pond liquid apparently increases odorous gases emitted from the pond, decreases the kinetic rate of biodegradation, decreases the pH, and decreases the amount of suspended solids. At a detention time of 15 days there was little difference among the pond configurations in the amount of organic carbon removal, but at a de-tention time of 1.5 days the difference was between 53% and 70%. Biological degradation rates were significantly higher in the baffled ponds than in the control pond, with the longitudinal baffle configuration providing the highest rate of reduction of soluble organic carbon concentra-tions. (Loustau-FIRL) W76-05590

TECHNICAL-ECONOMIC PRODUCT DESIGN AS TYPIFIED BY A SEWAGE PUMPING IN-STALLATION.

E. Arn, F. Schaer, and A. Trachsel. Sulzer Technical Review, Vol. 57, No. 3, p 169-176, 1975. 9 fig, 7 tab, 6 ref.

Descriptors: *Sewage treatment, Pumps, Economics, Sewage lagoons, Equipment, Engineering, Operation, Maintenance, Design criteria, Planning, *Pumping, *Waste water treatment.

Identifiers: Value analysis

A sewage pumping installation has been used as an example to describe the overall development of integrated technical-economic design and manufacture of engineering products. Waste water pumps are required to transfer domestic and industrial effluents, which have been collected in ponds, to a sewage treatment plant. In this case, public concern about sewage pumps has stressed the danger of clogging, and the need for high reliability, quiet operation, and an odor-free system. The four concerns--uncloggability, smell propagation, noise propagation, and motor reliability--were considered as one type of assessment criterion and were evaluated according to technical values. Other assessement criteria--excavation, concreting, maintenance, pipework and fittings, and installation work--were rated in terms of economicalues. Operating data, including flow, pressure increase, speed, efficiency, and pump drive input were also compared. Basic sketches of positive displacement, fluid flow, and other types of pumps were prepared. By combining solution principles to achieve an overall function, procedures may be decided. With the aid of a value analysis technique, the technical and economic optimal pumping system may then be selected. (Kramer-FIRL)

EFFECT OF THE OPERATIONAL TEMPERATURE IN REVERSE OSMOSIS METHOD (GYAKU SHINTO HO NI OKERU SOSA ONDO NO EIKYO), K. Kitao, M. Sugawara, and H. Ozaki.

K. Kitao, M. Sugawara, and H. Ozaki. Preprint, Japan Society of Civil Engineers, Tokyo, p 532-533, 1975. 7 fig.

Descriptors: *Reverse osmosis, *Membrane processes, *Temperature, *Pressure, Viscosity, Permeability, Solvents, Solutes, Surfactants, Analytical techniques, *Waste water treatment.

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The effect of temperature on the permeability of solvents and solutes in reverse osmosis was studied, using an acetylcellulose membrane. The solvents studied were pure water, methyl alcohol, ethyl alcohol, and n-propyl alcohol, while the solutes studied were NaC1, HgC12, and three surfactants in aqueous solution, all with a solute concentration of less than 10 mmole. Permeability was varied by changing the pressure between 0.5 and 50 kg/sq cm and the temperature between 3 and 31.5 C. At a constant pressure and temperature. the membrane permeability (K) decreased with the increased viscosity of the solvents. With variable temperatures, the membrane permeability was inversely proportional to the change in the viscosity of the given solvent at a given temperature, and the product between its K value and viscosity was nearly constant. For the solute in an aqueous system, there was a linear relationship between the solute permeation rate and the solution permeation rate for a constant temperature. The slope of the line became more steep when the higher temperature was used, which indicated that the adsorbed amount of solute within the membrane increased with lower temperature. The solute permeation rate increased more rapidly by changing temperature than by changing pressure even when the same solution permeation rate was obtained. (Katayama-FIRL) W76-05592

HOW DOES TANK GEOMETRY AFFECT THE OXYGEN TRANSFER RATE OF MECHANICAL SURFACE AERATORS.

Envirex, Inc., Waukesha, Wis. Water Quality Control Div. R. Kormanik

Water and Sewage Works, Vol. 123, No. 1, p 64-67, January, 1976.

Descriptors: Oxygen, *Aeration, Equipment, Tanks, Laboratory tests, Analytical techniques, Data collections, *Waste water treatment. Identifiers: *Oxygen transfer rates, Basin geometry, *Aerator speeds.

To determine the influence of test basin geometry on the oxygen transfer capabilities of mechanical surface aerators, tests of three types of surface aerators were conducted in six geometric test tank configurations. The three types of aerators tested were the high speed-high trajectory, high speedlow trajectory, and a low speed bridge mounted unit. The test basin geometry was varied by using an 80 ft by 80 ft by 20 ft deep tank and partitioning it into quarter and half sizes. The aerators were tested at 12 ft and 18 ft depths at 15, 30, 50, and 75 HP speeds. The oxygen transfer rate of a surface mechanical aerator at standard conditions was not affected by the water depth of the test basin. The correlation between oxygen transfer rate and basin surface area was much closer than the correlation between oxygen transfer rate and basin volume. Because of this finding, it was recommended that when a standard transfer rate is quoted, the associated value of surface area should also be indicated. For high speed aerators, the lower the aerator horsepower, the greater the influence of basin geometry. The oxygen transfer rate of the low speed aerators at standard conditions was far less affected by basin geometry than that of the high speed type. (Loustau-FIRL) W76-05593 STREAM ANALYZERS ARE FOR WASTE AS

WELL AS PRODUCT,
For primary bibliographic entry see Field 5A.
W76-05596

LIME-INDUCED REACTIONS IN MUNICIPAL

WASTEWATERS, Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering. D. T. Merrill, and R. M. Jorden.

Journal Water Pollution Control Federation, Vol. 47, No. 12, p 2783-2808, December, 1975. 11 fig, 29

Descriptors: *Model studies. *Waste water treatment, *Lime, Chemical precipitation, Municipal wastes, Mathematical models, Phosphate,

If steady-state soluble constituent concentrations can be attained within reasonable times in limetreated raw waste systems, then the interaction of lime and the constituents of municipal waste water be described through equilibrium-based mathematical models. The models can interpret system reaction phenomena and identify limitations that designers and treatment plant operators must face. Experiments were carried out with raw, degritted waste water and additions of lime of 150, 250, and 350 mg/liter so that data might be obtained over the pH range of effective phosphate precipitation. The waste water and lime samples were analyzed for soluble Ca sub t, CO sub 3t, PO sub 4t, and Mg sub t, and the results recorded on a graph. Then the equilibrium behavior of limetreated waste at simulated conditions was calculated by application of water chemistry theory Analyses indicated that total phosphate residuals are insensitive to initial waste concentration at pH values greater than or equal to 10, suggesting that pH could be a good control parameter in regard to PO4 removal. Lime treatment will neither soften water nor eliminate salt efficiently. Lime requirements and the mass of chemical sludge produced are highly dependent on the initial waste CO sub 3t concentration. Lime requirements run 10 to 50 percent higher than theoretically predicted because lime only partially dissolves. Increasing the ratio PO sub 4t:CO sub 3t in the initial waste water may, in some cases, produce substantial processing economies. (Loustau-FIRL) W76-05597

OPTIMAL DESIGN MODEL FOR WASTE WATER COLLECTION SYSTEM (II) (GESUIDOKAN KIYO KEIKAIU NO SAITEKIKA MODERU TO SONO OYO (II)), K. Yamada.

Ritsumeikan Daigaku Rikogaku Kankyusho Kiyo, (Memoirs of the Research Institute of Science and Engineering, Ritsumeikan Univ.), No. 28, p 17-28, 1975. 13 fig, 9 tab, 18 ref.

Descriptors: *Model studies, *Economics, *Construction costs, *Waste water treatment, models, Variable costs, *Ontimization.

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A three dimensional model to determine the op-timal waste water collection system has been proposed. The model was constructed on the as sumptions that the number of arcs was 25, the length of each arc was 250 m or 500 m, the number of rankings for the excavation depth was 10, the width of each ranking was 25 cm or 50 cm, the maximum flow rate was 2.5 m/sec, the minimum flow rate was 0.6 m/sec, and the rate of waste water generation was 2 liters/sec/10,000 sq m. The model employed ten different factors, each of which had two different values assigned. These factors and their assigned values were: x-directional gradient of the upper stream, 0.5 and 2.0; x-directional gradient of the lower stream, 0.5 and 2.0; y-directional gradient of the upper stream, 0.5 and 2.0; y-directional gradient of the lower stream, 0.5 and 2.0; additional flow rate increase factor, 1.0 and 1.2; additional main sewage line construction cost increase factor, 0.0 and 0.2; flow rate variation, 0.0 and 0.2 Q; groundlevel varia-0.0 and 0.1 m; construction cost variation, 0.0 and 0.1 C; and excavation depth of the final node, 4 m and 2 m. Using sixteen combinations of values for the ten factors, the total construction costs for each combination were calculated; the range of costs was between \$555,300 and \$1,984,000. An analysis of variance was made for the calculated results to see the effect of the factors on the derived construction costs. The factors of groundevel variation, x-directional gradient of the lower stream, and y-directional gradient of the lower stream contributed 84% of the variation in construction costs. (Katayama-FIRL)

PROCEEDINGS - CONFERENCE ON WATER CONSERVATION AND SEWAGE FLOW REDUCTION WITH WATER-SAVING DEVICES.

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-250 999, tion Service, Springifield, Va 2216t as PB-230 98; \$7.75 in paper copy, \$2.25 in microfiche. Informa-tion Report Number 74, July 1975, 216 p, Con-ference held April 8-10, 1975, Pennsylvania State University. Edited by W. E. Sharpe and P. W. Fletcher. OWRT A-038-PA(1). 14-31-0001-4038.

Descriptors: *Water conservation, *Water resources development, *Water reuse, Water treatment, Ultimate disposal, Sewage treatment, Sewage disposal, Consumption use, Reasonable use, Water utilization, Technology, Reviews. Identifiers: *Water-saving devices, *Water use

These proceedings are a current state-of-the-art assessment of water-saving device technology in the United States. The papers address themselves to the major questions associated with water-saving device development and use. The gaps in current knowledge are enumerated and the information necessary to fill these gaps is identified. The information contained in these proceedings will be of benefit to a broad spectrum of concerned individuals from the researchers to the facilities manager. Water conservation will be a definite part of America's future and water-saving devices have already begun to take their place in this con-servation effort. Water resources development grows more expensive each day, as does the cost of treating the inevitable flow of wastes resulting from most water uses. Water use reduction with water-saving devices offers a major opportunity to alleviate some of these most pressing resource management problems. (Sink-Penn State)

FOR WHICH LOAD SHALL MUNICIPAL PURIFICATION PLANTS BE DIMENSIONED. (FUER WELCHE BELASTUNG SOLLEN KOM-MUNALE KLAERANLAGEN BEMESSEN WER-DEN). J. Gruhler.

Wasserwirtschaft-Wassertechnik, Vol. 25, No. 11. p 364-368, 1975. 2 fig, 9 ref.

Descriptors: *Biological treatment, *Municipal water, *Treatment facilities, *Model studies, Or-ganic compounds, Water quality control, Biochemical oxygen demand, *Waste water treat-

Identifiers: Dimensioning, Post-treatment basins, Waste discharge.

Considerations in the dimensioning of municipal biological waste water treatment plants are presented. The waste water discharge for which these treatment plants should be dimensioned is determined from measurements of discharge and organic matter load, and the long-term evaluation

of these parameters should be considered. The purification efficiency is determined by the water quality of the recipient. The fluctuations in the quantity of the incoming waste water should be considered mainly in the dimensioning of the post-treatment basin rather than in that of the aeration basin. The minimum residence time in the posttreatment basin should not be shorter than 1.5 hours. Biological waste water treatment plants should be dimensioned for a daily BOD load in kg/day of water discharged into the effluent, and not for hourly peaks, as short-term BOD peaks represent no hazard for the recipient. (Takacs-FIRL)

NOMOGRAMS FOR SIMPLIFIED HYDRAULIC DIMENSIONING OF WASTE WATER DUCTS (NOMOGRAMME ZUR VEREINFACHTEN HYDRAULISCHEN BEMESSUNG VON AB-WASSER-KANAELEN),

M. Szalay. Gas-und Wasserfach-Wasser/Abwasser, Vol. 116, No. 9, p 415-417, September, 1975. 3 fig.

Descriptors: *Model studies, *Waste water treatment, *Pipes, *Flow velocity, Sewers, Mathemati-cal studies, Hydraulics. Identifiers: *Nonograms, Waste water ducts.

A simplified nomogram for the dimensioning of waste water ducts, obtained by an integration of filling curves and the usual dimensioning nomograms, is described for circular and egg-shaped duct sections. The new nomogram makes it possible to obtain the dimensioning data in a single The nomograms developed for circular and egg-shaped sections permit the determination of the necessary pipe diameter, the mean water flow velocity, the water depth, and the time required for the water to clear a 100 meter section, as a function of the discharge rate and of the gradient of the sewer. (Takacs-FIRL) W76-05610

PERSPECTIVE 75.

East Central Florida Regional Planning Council, Winter Park. For primary bibliographic entry see Field 6B. W76-05651

PROCESSING OF SEDIMENTS FROM COAGU-LATION APPLIED AS THE THIRD STAGE OF EFFLUENT PURIFICATION (PRZERABIANIE POWSTAJACYCH ZASTOSOWANIU KOAGULACJI JAKO TR-ZECIEGO STOPNIA OCZYSZCZANIA SCIEKOW Z PRZEMYSLU WŁOKIENNIC-

ZEGO), Centralne Laboratorium Dziewiarstwa (Poland).

Przeglad Wlokienniczy, Vol. 29, No. 9, p 452-455, Sept., 1975. 5 ref. 6 tab.

Descriptors: "Waste water treatment, "Coagulation, "Sludge, Waste treatment, Waste, Calcium hydroxide, Color, Biochemical oxygen demand, Suspended solids, Filtration, Sedimenta-tion, Textiles, Water pollution sources, Water pollution treatment, Water pollution control, Tertiary

Coagulation as the third treatment stage in sewage purification has been used for a long time. In a case of industrial effluents, coagulation usually constitutes a preliminary process to biological purification or a single-stage process. It yields large quantities of highly hydrated sediments, very difficult to process. Frequently, the effluents are purified biologically without preliminary coagulation. Such purified effluents, in the particlar case of the industry frequently do not meet the present antipollution regulations and must be subjected to further purification. The results are given of a study of additional purification by coagulation of

Group 5D-Waste Treatment Processes

effluents that have been treated mechanically and by the activated sludge process, to remove their color and various residual impurities. The study was conducted on an effluent with a dry solids content of 3160 mg/cu dm and a 5-day BOD of 250 mg/cu dm. Coagulation was done with 400-450 mg mg/cu dm. Coagulation was done with 400-450 mg calcium hydroxide/cu dm and 200-250 mg ferrous sulfate/cu dm. Complete removal of color and a reduction of 40-45% BOD and of 50% suspended solids were obtained. The sediments were concentrated by gravity and by vacuum and pressure fil-tration. In all cases the efficiency was high; a 10fold reduction of the initial volume. Sedimentation took 2-4 hr, and the filterability was good. The results are attributed to the presence of carbon dioxide in the biologically purified effluent yield-ing, upon reaction with calcium hydroxide, a crystalline sediment. (Stapinski-IPC) W76-05697

USE OF ION EXCHANGERS AND SYNTHETIC SORBENTS FOR REMOVAL OF COLOR FROM KRAFT PROCESS EFFLUENTS (PROBY ZASTOSOWANIA JONITOW I SORBENTOW SYNTETYCZNYCH DO USUWANIA BARWY ZE SCIEKOW POSIARCZANOSYCH).

Technical Univ., Lodz (Poland). S. Wiktorowski, P. Anielak, and M. Kubik. Przeglad Papierniczy, Vol. 31, No. 9, p 331-334, Sept., 1975. 7 fig, 17 ref, 3 tab. English summary.

Descriptors: *Pulp wastes, *Waste water treatment, *Color, *Ion exchange, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Water pollution control, Lignins, Hydrogen ion concentration. Waste treatment. Water purification, Separation techniques, Activated carbon, Sorption.
Identifiers: Indulin C, Amberlite IRA-900, Zerolit

KMP, Zerlit NIP, Amberlite XAD-2, Wofatit

The effectiveness of synthetic sorbents and ionexchangers in removing color components (i.e., al-kali lignin from kraft mill effluents) was studied under laboratory conditions on a model effluent, i.e., solutions of Indulin C (unpurified sodium salts of kraft process lignins). The color intensity de-pended on concentration and on the pH. There was little change of intensity within the pH range 3-9, but a sharp increase at higher pH. The solu-tions used in the study had a concentration ranging from 82 to 410 mg/cu dm, based on oven-dry Indu lin. The color intensity at pH 7 raged from 500 to 2500 mg Pt/cu dm. The following preparations were tested: strongly alkaline anion exchangers Amberlite IRA-900, Zerolit KMP, and Zerolit NIP; GM-800 exchangers of medium alkalinity; synthetic sorbent Amberlite XAD-2; nd the strongly acidic cation exchanger Wofatit KPS. For comparison purposes, experiments were also car-ried outwith activated carbon as sorbent. Sorption of Indulin was conducted under dynamic condi-tions in columns filled with the sorbents, and the sorption effectiveness was determined by measurements of the optical extinction of eluent fractions at 420 nm. The ion-exchanger GM-800 (guanidine-melamine resin) was the most effective, removing from 54 to 89% of the color, depending of the initial color intensity. Amberlite XAD-2 was quite effective at low pH (2 or below). (Stapinski-IPC) W76-05698

HYDRAULIC LOAD FLUCTUATION IN EF-FLUENT TREATMENT PLANTS (HYDRAULICKE NARAZY NA SEDIMENTAC-NI CISTIRNY ODPADNICH VOD), P. Sochan

Papir a Celuloza, Vol. 30, No. 11, p 251, 1975. 1

Descriptors: *Waste water treatment, *Treatment facilities, Flow, *Model studies, Effluents, *Pulp and paper industry, *Wastes, Industrial wastes, Water pollution sources, Water pollution contri.

Waste dilution, Surge tanks, Hydraulic systems, Hydrodynamics.

For a paper mill which has, besides a white water circuit, an effluent treatment plant with partial reuse of the treated water, an empirical unsteadystate model was developed to study hydraulic load fluctuations. The results showed that, for the time base of 15, 60, and 120 minutes, the average hydraulic load changed by plusor minus 80%, plus or minus 40%, and -20 to +40%, respectively. To reduce the extent of flow fluctuations, a reduction in tank volumes for diluted stock and stock dilution water is recommended. Another, though costly, alternative for the elimination of hydraulic load fluctuation is the installation of a surge basin ahead of the treatment plant. (Trubacek-IPC)

INFLUENCE OF TEMPERATURE ON BIOLOG-ICAL PURIFICATION OF PAPER MILL EF-FLUENT (INFLUENZA DELLA TEMPERATU-RA SULLA DEPURAZIONE BIOLOGICA DI UN

REFLUO DI CARTIERA), V. Scarlata, E. Porrozzi, R. Bignazzi, and R. Caminada.

Cellulosa e Carta, Vol. 26, No. 10, p 26-41, Oct., 1975. 13 fig. 35 ref, 1 tab.

Descriptors: *Pulp wastes, *Activated sludge, *Waste water treatment, *Temperature, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Water pollution control, Efficiencies, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Stabilization, Sludge, Biochemical treatment, Design, Treatment facilities, *Biological treatment.

Two activated-sludge pilot plants operating at 20 and 4 C, respectively, were compared with respect to efficiency. Both were run on the same pulp/urea-based substrate. The plant operating at the higher temperature was found to be more efficient in most respects. Maximum reduction in BOD, COD, and suspended solids were on the order of 20-30%. Activated sludge stabilization was also much quicker at 20 C. However, at 4 C, there was less excess sludge, and its physical behavior was more satisfactory. The results obtained show that operating temperature should al-ways be taken into account in designing biological treatment plants. (Speckhard-IPC) W76-05700

ENERGY REQUIREMENTS FOR CONVEN-TIONAL AND ADVANCED WASTEWATER TREATMENT,

Ontario Ministry of the Environment, Toronto. Applied Science Section. G. D. Zarnett.

Ontario Ministry of the Environment, Applied Sciences Section Pollution Control Branch Publication No. W47, 33 p, Oct., 1975. 6 fig, 5 ref, 11

Descriptors: *Waste water treatment, *Tertiary treatment, *Energy, Waste treatment, Electric power, Operation and maintenance, Chemicals, Operating costs, Equipment, Lime, Aluminum sulfate, Chlorine.

The energy demand for operation of conventional and advanced effluent treatment systems are compared, including not only electrical power but also the energy needed to produce treatment chemi-cals, notably lime, alum, and chlorine. When this show substantial increases in total energy consumption over conventional systems. The power increment resulting from the addition of lime and alum coagulants/flocculants ranges from 40 to 84%, whereby increments above 50% indicate that the energy required for chemical generation is greater than the electrical power needs of the ef-fluent treatment system. While electric operating energy is comparable for both simple and advanced treatments, total energy needs of advanced systems are one order of magnitude greater than for conventional installations. Electrical equipment (pumps, agitators, mixers, rakes, skimmers, ponential proportion to plant size or capacity, whereas the increase of chemical energy with plant capacity is a linear function of applied dosage. (Brown-IPC) blowers, vacuum filters, vibratory screens, cen-trifugal separators, etc.) consumes power in ex-

STUDY OF TURBINE MIXERS FOR FLOW-THROUGH FLOCCULATION CHAMBERS (VYZKUM TURBINOVYCH MICHADEL PRO PRUTOCNE FLOKULACNI KOMORY).

Vyzkumny Ustav Chemickych Zarizeni, Brno (Czechoslovakia).

P. Seichter. Chemicky Prumysl, Vol. 25, No. 9, p 453-462, Sept., 1975. 9 fig, 24 ref, 7 tab.

Descriptors: *Waste water treatment, *Mixing, *Turbines, Equipment, Waste treatment, Model studies, Engineering, Flocculation, Flow characteristics, Foreign research, Wastes, Water pollution treatment, Europe.
Identifiers: *Czechoslovakia.

In connection with the optimization of water treatment equipment, an engineering study of turbine mixers was carried out. A flow model for the determination of the detention time in a chamber with four mixing sections was developed. The ON 691021 (Czechoslovakia) was found to be the most suitable type of mixer for a flocculation chamber. With regard to the use of the model characteristics for the design of large flocculation chambers, it is pointed out that the scaling-up can be done based on geometric similarity, but the peripheral velocity of the mixer should be kept constant. (Trubacekipc) W76-05703

EXPERIMENTS ON THE OPTIMIZATION OF SLUDGE DEWATERING AND ON THE USE OF BARK AND SLUDGE IN THE BRICK INDUS-TRY (VERSUCHE ZUR OPTIMIERUNG DER SCHLAMMENTWAESSERUNG UND ZUR VER-WERTUNG VON RINDE UND SCHLAMM IN DER ZIEGELINDUSTRIE), Papiertechnische Stiftung, Munich (West Ger-

Wochenblatt fuer Papierfabrikation, Vol. 103, No. 22, p 833-839, Nov. 30, 1975. 9 fig, 11 illus, 25 ref, 1 tab.

Descriptors: *Pulp wastes, *Sludge treatment, *Sludge disposal, Water pollution sources, Wastes, Industrial wastes, Dewatering, Zeta potential, Flocculation, Waste water treatment, Sludge, Bark, Wood wastes, Fuels, Transportation, Costs, Pulp and paper industry, Clays, Construction materials.
Identifiers: *Bricks.

A brief discussion of flocculation and dewatering of paper mill wastes is followed by a description of experiments on effluents from a coated paper mill, showing the relationship between SCD (streaming current detector) zeta-potential value, amount of flocculant added, and sludge separation. The addi-tion of sludge to clay in brickmaking lowers brick density and produces increased porosity and a finer pore structure. This is due largely to the fiber content of the sludge; a combination of sludge with bark seems promising, but bark, like other wood residues, is a useful fuel. Brick factories are idle usually in winter and could not, in any case, utilize all the sludge from a large paper mill, but even partial utilization would reduce disposal and transport costs. Besides, both fiber and mineral content are used in the brick, whereas disposal by burning requires some capital costs and disposal of the ash. (Ward-IPC) W76-05704

RAPID DETERMINATION OF THE COD OF EFFLUENTS (USKORENNOE OPREDELENIE KHPK STOCHNYKH VOD),
Tsentral'nii Nauchno-Issledovatel'skii i Proektnii

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Lesokhimicheskoi Promyshlennosti. Institut

Institut Lesokhimicheskoi Promyshleni Khimki (USSR). For primary bibliographic entry see Field 5A. W76-05705

SUPER TEAMWORK GIVES GREEN BAY (WISCONSIN) A SUPER WASTE TREATMENT PLANT,

K. Boiko Paper Trade Journal, Vol. 159, No. 27, p 32-36, Dec. 1, 1975. 3 fig, 1 ref, 3 tab.

Descriptors: *Pulp wastes, *Waste water treat-ment, *Wisconsin, *Activated sludge, *Treatment facilities, Water pollution source, Waste, Industri-al wastes, Waste treatment, Water pollution treat-ment, Water pollution control, Sewage treatment, Biological treatment, Capital costs, Municipal wastes.

Identifiers: Green Bay Metropolitan Sewerage District(Wisc), Fox River(Wisc).

After pilot plant studies with different modifications of the activated sludge process (conventional, step aeration, contact stabilization, (conventional, step aeration, contact stabilization, and the Kraus process), two paper mills and the Green Bay Metropolitan Sewerage District signed a contract to treat mill wastes together with city sewage in a \$72 million waste treatment facility located on 92.9 acres at the mouth of the Fox River. The treatment plant started up with 22 million gallons/day (mgpd) of sewage from the metropolitan area and 17.5 mgpd from the mills. Total design capacity is for an eventual flow of \$2. Total design capacity is for an eventual flow of 52 mgpd. In the treatment process, mill effluent enters the plant at the pumping station. It bypasses the primary treatment (screening and first settling basin) and proceeds directly to the biological treat-ment stage. Solids accumulated from these two phases proceed to the third phase where they are transformed into sterile ash and gas. The gases are washed and filtered to meet air quality standards. Odorous gases are collected and burned, and residual ash is disposed of at landfill sites. (Sykes-IPC) W76-05706

LAB-PROVEN FLY ASH PROCESS REMOVES BLEACH EFFLUENT COLOR, M. S. Nasr, R. G. Gillies, N. N. Bakhshi, and D. G.

Macdonald.

Canadian Pulp and Paper Industry, Vol. 28, No. 9, p 30-32, 35, Sept., 1975. 4 fig.

Descriptors: *Bleaching wastes, *Color, *Waste water treatment, *Fly ash, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Water pollution con-trol, Chemical oxygen demand, Hydrogen ion concentration, Chemical precipitation, Metals, Ions, Pulp wastes, Electric powerplants, Coals, Fuels, Chemical reactions, Sludge. Identifiers: Hydrogen chloride.

A method is described for removing most of the color from pulp mill effluent by using HCl and fly ash from coal-burning electricity generating plants, based on research conducted at the University of Saskatchewan. With untreated fly ash, exsity of Saskatchewan. With untreated fly ash, extremely large doses were required to obtain 51% color removal. Effluent samples were treated with various dosages of completely HC1-acidified fly ash, and the filtered to determine COD, color, and pH of the filtrate samples. A maximum 98% color removal and 88% COD removal were obtained with a disage of 1.9 g fly ash/liter of undiluted effluent (12,000 APHA color units, 2480 ppm COD) at an onlinum pH of 50 Acidification of the effat an optimum pH of 5.0. Acidification of the ef-fluent contributed to some of the color decrease during treatment with acidified fly ash, but most of the color removal was the result of precipitation of colored material by reaction with metal ions

released from fly ash. Sludges formed by such treatment did not leach to any significant extent. (Sykes-IPC)

ELECTROLYTIC COAGULATION OF LIGNIN FROM KRAFT MILL BLEACH PLANT WASTE-

Main (Charles T.), Inc., Boston, Mass. D. O. Herer, and F. E. Woodard. Tappi, Vol. 59, No. 1, p 134-136, Jan., 1976. 5 fig, 15 ref, 1 tab.

Descriptors: *Waste water treatment, *Lignins, *Coagulation, *Electrolysis, *Bleaching wastes, Pulp wastes, Water pollution sources, Water polrup wastes, water pollution sources, water pollution treatment, Water pollution control, Wastes, Waste treatment, Industrial wastes, Flotation, Aluminum, Ions, Anodes, Chlorides, Cathodes, Economics, Color, Chemical reactions. Identifiers: Aluminum compounds.

The feasibility of using electrolytic coagulation to remove color and other carbonaceous materials from kraft pulp mill bleach plant waste water was studied. Removal mechanisms were found to consist of coagulation by hydrated aluminum ions which were brought into solution by electrolytic dissolution of the aluminum anode. Bleaching of small color-causing polymers by chlorine formed by oxidation of chloride ions at the anode was shown to be improbable. Hydrogen bubbles formed at the cathode aided removal of coagulated polymers by a flotation action. The optimization of process parameters was considered in view of such a removal mechanism, and the economic feasibility of a full-scale unit was evaluated. (Sykes-IPC) W76-05708

ANALYSIS OF PULP AND PAPER MILL WASTE WATERS BY HIGH-RESOLUTION ION-EXCHANGE CHROMATOGRAPHY,

Oregon Univ., Portland. For primary bibliographic entry see Field 5A. W76-05709

SYMPOSIUM ON WATER PURIFICATION (SYMPOSIUM OVER VATTENRENING),

Svensk Papperstidning, Vol. 78, No. 18, p 633-638, Dec. 20, 1975. 2 fig, 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Biological treatment, *Conferences, Water ment, Biological treatment, Conterences, water pollution sources, Water purification, Waste treat-ment, Wastes, Industrial wastes, Economics, Technology, Foreign countries, Europe. Identifiers: *Sweden, Scandinavia.

A fairly detailed report is presented on a symposi-um devoted to biological pulp and paper mill ef-fluent treatment organized on November 12, 1975 by Purac AB, and Hylte Bruks AB. Practical waste water cleanup experiences of three Swedish mills (Hyltebruk, Hallstavik, and Boksholm) are discussed, including economic, policy, and technological problems. (Brown-IPC) W76-05711

BIOLOGICAL TREATMENT BY A SYSTEM OF ACTIVATED SLUDGE APPLIED TO THE EF-FLUENT WATERS OF A CORRUGATED BOARD PLANT,

Centro di Sperimentazione Cartotecnica, Milan

V. Scarlata, and E. Porrozzi.
Proceedings XIII FEFCO (Federation Europeenne des Fabricants de Carton Ondule) Congress (Venice), May 20-24, 1974. 15 p, 2 fig, 17 ref, 2 tab.

Descriptors: *Activated sludge, *Biological treatment, *Waste water treatment, *Chemical wastes,

Water pollution sources, Wastes, Industrial wastes, Water pollution treatment, Water pollution control, Chemical oxygen demand, Biochemical oxygen demand, Microorganisms, Toxicity, Nutrients, Phosphorous compounds, Nitrogen compounds, Aluminum sulfate, Sludge, Sedimentation, Effluents, Pulp and paper industry. Identifiers: *Inks, *Printing industry, *Converting plants(Paper processors), Corrugated board, Corrugated board,

rugated boxes, Flexographic inks, Graphic arts in-

A laboratory pilot plant was used to examine the feasibility of activated sludge plus total bio-oxidation treatment for effluents of a converting plant making corrugated boards and printed boxes. For making corrugated boards and printed boxes. For satisfactory purification, the printing effluent had to be treated separately, owing to the toxicity of flexographic inks toward activated sludge microorganisms. Also, P, N, and alum had to be added as nutrients and to improve sludge sedimentation. Under these beneficial conditions, the activated with the sedimentation of the sedimentati tation. Order these benefited conditions, the activated sludge plant removed 92.6% BOD and 88.4% COD of the influent within 2.5-hr treatment time, compared to 96.2% BOD and 91.3% COD removal within 24-h by the total bio-oxidation plant. Dye-contaminated printing effluents will require a separate physicochemical treatment, or the inks will have to be replaced by less toxic ones. (Brown-IPC) W76-05713

STATUS OF WATER POLLUTION CONTROL IN THE SOVIET UNION, Crown Zellerbach Corp., Camas, Wash. For primary bibliographic entry see Field 5G.

W76-05714

EXPERIMENTAL STUDY OF THE PURIFICA-TION OF EFFLUENTS FROM THE MANUFAC-TURE OF BLEACHED BISULFITE PULP BY AERATION LAGOONING (ETUDE EXPERI-MENTALE DE L'EPURATION PAR LAGU-NAGE AERE DE LIQUEURS BISULFITIQUES DE BATE DE CELLULOSE BI ANGUIES. DE PATE DE CELLULOSE BLANCHIE),

Bordeaux Univ. (France). A. Chantefort, M. Marchand, and J. Sechet. Tribune de CEBEDEAU, Vol. 27, No. 367/368, p 294-302, 1974. 5 fig, 6 ref., 6 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Aerated lagoons, Sulfite liquors, Wastes, Industrial wastes, Water pollution sources, Waste treatment, Water pollution treatment, Water pollution control, Biochemical oxygen demand, Chemical oxygen demand, Hydrogen ion concentration, Nutrients, Chlorine, Microorganisms, Lagoons, Aeration, Color, Lignins, Phenols.

The study was conducted on effluent from a pulp mill producing two types of ammonium-base sulfite pulp, a papermaking pulp and a dissolving pulp, from a mixture of Maritime pine and hardwood. The pulps are bleached by a CHD (chlorine/hypochlorite/chlorine dioxide) sequence. The spent sulfite liquor is concentrated and burned, so that the effluents to be purified include the effluent generated by spent sulfite liquor evaporation (30% of BOD), pulp wash water (34% of BOD). or BOD), and the bleaching effluent (36% of BOD), and the bleaching effluent (36% of BOD). The total amount of these effluents is 60,000 cu m/day. The following aspects of the treatment, evaluated in terms of BOD and COD reductions, were considered: optimum initial pH, addition of nutrients, effects of BOD load and of the presence of chlorine, and the microflora evolu-tion during the course of treatment (up to 9 days). tion during the course of treatment (up to y days). The data show that under optimum conditions (initial pH of about 5, elimination of chlorine, addition of nutrients, and possible microbial inoculations) a reduction of BOD of up to 90% and of COD of about 50% can be achieved. The lagoon needed would have to be of 300,000 cu m capacity and be equipped with means for maximum aeration and for homogeneous distribution of additives (nutrients and alkali for pH adjustment). A

Group 5D-Waste Treatment Processes

problem remaining to be solved is the strong coloration of the purified effluents, caused by par-tial oxidation of phenolic compounds originating from lignin. (Stapinski-IPC) W76-05718

BLEACH PLANT POLLUTION ABATEMENT --WHERE DO WE STAND,

Hooker Chemicals and Plastics Corp., Niagara Falls, N. Y. E. S. Atkinson.

Canadian Pulp and Paper Industry, Vol. 28, No. 9, p 22-24, Sept., 1975, 17 ref. 3 tab.

Descriptors: *Bleaching wastes, *Waste water treatment, Recycling, Effluents, Water pollution sources, Water pollution treatment, Pollutants, Color, Biochemical oxygen demand, Toxicity, Chemical oxygen demand, Chlorides, Costs, Resins, Ion exchange, Energy, Water conservation, Pollution abatement, Pulp and paper industry.

Identifiers: Oxygen bleaching, Kraft mills, Chemical recovery.

Work aimed at using bleach plant effluent in the bleaching offers the possibility of recycled ef-fluent, but the process is not sufficiently developed to solve the pollution abatement problem. Tables indicate the approximate distribu-tion of pollutants (color, BOD, toxic constituents, COD, and chlorides) between bleaching stages; the estimated cost of external pollution abatement for a kraft pulp mill; and cost of pollution abatement at different BOD levels. Hooker Chemicals and Plastics Corp. (New York) APS projects for assisting the industry in antipollution efforts are discussed. APS-1 is designed to reduce effluent color through changes in bleaching sequences and conditions. With APS-2, chlorination is replaced by sequential chlorination, but at a chlorine dioxide substitution as high as 75-80%, to minimize the chloride content of bleach plant liquors. In APS-3, acid effluent is treated with a color-absorbing macroporous resin. The resin is regenerated with alkaline extraction liquor, and the effluent is added to other alkaline extraction liquors going to the recovery/cooking cycle. It is suggested that a countercurrent pulp washing system is a necessary requirement for establishing a pollution abatement program. The closing up of the bleach plant is also an energy- and water-saving step. (Sykes-IPC) W76-05719

PURIFICATION OF WASTE WATERS AT THE KRAFT MILL OF 'LA CELLULOSE DES ARDENNES' (EPURATION DES EAUX RESIDUAIRES A LA CELLULOSE DES ARDENNES), G. Berwart.

Technique de l'Eau et de l'Assainissement, Vol. 335, p 51-57, 1974. 3 fig, 4 tab.

Descriptors: *Pulp wastes, *Waste water treat-*Activated sludge, Biological treatment, Bleaching wastes, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Water pollution treatment, Water pollution control, Sludge treatment, Sludge disposal, Biochemical oxygen demand, Efficiencies, Water purification, Foreign countries, Filtration, Landfills, Europe, Costs, Operating costs. Identifiers: Kraft mills, France.

A kraft pulp mill located in Harnoncourt (France) began its operations in 1964. Its initial capacity of 200 tons of bleached pulp/day has been increased recently to 500 tons. The pulp is produced exclusively from local hardwoods (beech, hornbeam, birch, and oak) and is bleached in a five-stage process including a hypochlorite and a chlorine dioxide stage. Black liquor and pulp-washing effluents are evaporated and burned in a soda recovery furnace. Bleaching effluents and recovery furnace. Bleaching effluents and evaporation and blow-out condensates are purified

by the activated sludge process. The sludge (from by the activated studge process. The studge (from primary sedimentation and excess activated studge) is filtered and disposed of in a landfill or sold as a soil conditioner. The capacity of the biological treatment plant has been increasing at a faster rate than the pulp production, allowing improvements in its efficiency. The BOD of the purified effluent which was 25-40 ppm in 1965, is presently 22 ppm or a 92.6% reduction. A descripproduction line and the biological treatment process, and data are presented illustrating the efficiency of the treatment plant. Treatment costs run over 45 million francs annually. (Stapinski-W76-05721

POSITION OF A CALCIUM BISULFITE PULP MILL PARTICULARLY WITH RESPECT TO INTENSIFIED ENVIRONMENTAL PROTEC-TION REQUIREMENTS (DIE POSITION EINER KALZIUMBISULFITFABRIK, BESONDERS IM HINBLICK AUF VERSCHAERFTE UM-WELTSCHUTZFORDERUNGEN),

Helsinki Univ. of Technology, Otaniemi Finland. For primary bibliographic entry see Field 5G.

W76-05722

ESCHER-WYSS FLOTATION CELLS CLARIFICATION AND CLEANING ESCHER-WYSS FLOTATIONSZELLEN FOR DIE ZUR KLAERUNG UND REINIGUNG),

Escher Wyss G.m.b.H., Ravensburg (West Ger-

W. H. Matzke, and W. H. Siewert. Das Papier, Vol. 29, No. 10A, p V160-166, Oct., 1975. 11 fig. 5 illus.

Descriptors: *Flotation, *Waste water treatment, *Pulp wastes, Equipment, Cleaning, Water pollu-tion sources, Water pollution treatment, Wastes, Industrial wastes, Waste treatment, Operation and maintenance, Design, Separation techniques, Water purification, Suspension, Water quality control, Water pollution control. Identifiers: Clariflot, Unicell, Deinking, Waste

Flotation is a process for the separation of solid matter from a suspension. If flotation is aimed at the removal of all solid matter contained in the suspension, one speaks of clarification. If, however, selective removal of certain solid matter (e.g., printing ink particles from waste paper) is involved, the fiber suspension is cleaned. For both processes, Escher Wyss GmbH. has developed new devices ('Clariflot' for clarification, 'Unicell' for cleaning) which are described with respect to design and operating principles. They are characterized by small volume for purification and by low specific power and space requirements for cleaning. Operating results with recirculated waste water from washing-deinking units and from paper machines demonstrate the effect of the clarific tion flotation cells. Through the removal of solids, a desired ash reduction can also be achieved. As regards cleaning, the paper reports on flotation deinking units in which diverse waste papers are processed into bright and clean pulps. (Speckhard-IPC) W76-05723

OPTIMIZING ORGANIC CARBON AND COLOR REMOVAL FROM A BOARD MILL EF-

Saskatchewan Univ., Saskatoon, G. Goos, C. P. Hwang, and E. Davis.
American Institute of Chemical Engineers (A.I.Ch.E.) Symposium Series, Vol. 70, No. 144, p 213-218, 1974. 10 fig, 6 ref, 2 tab.

Descriptors: *Pulp wastes, *Coagulation, *Waste water treatment, Organic compounds, Carbon, Color, Lime, Cations, Anions, Polyelectrolytes, Water pollution sources, Water pollution treat-

ment Water pollution control Wastes Industrial wastes, Waste treatment, Activated sludge, Calcium carbonate, *Optimization. Identifiers: Board mills, Aluminum sulfate, Ferric

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Activated sludge treatment of a board mill effluent markedly reduces the strength but leaves a waste high in organic carbon and color. Optimization of coagulation for the removal of these two parameters was undertaken through the use of lime, alum, and ferric chloride in conjunction with cationic, anionic, and nonionic polyelectrolytes at 5-27 C Ferric chloride was more effective than lime, and lime more effective than alum. Little benefit was obtained from the addition of polyelectrolytes. (Witt-IPC)

CONTROL OF COAGULANT RECOVERY FROM EFFLUENT SEDIMENT (KONTROL' REGENERATSII KOAGULYANTOV IZ OSAD-KA CTOCHNYKH VOD),

Nauchno-Issledovatel'skii Institut Sanitarnoi Tekhniki i Oborudovania Zdanii i Sooruzhenii.

For primary bibliographic entry see Field 5E. W76-05725

REDUCTION OF EFFLUENT VOLUME AND FRESH WATER CONSUMPTION (SNIZHENIE OB'EMA CTOCHNYKH VOD I RASKHODA SVEZHEJ VODY),
Vsesoyuznyi Nauchnii Planovii Otdel Bumazhnoi

Promyshlennosti Moscow (USSR). For primary bibliographic entry see Field 3E. W76-05727

EXPERIENCES AND POSSIBILITIES WITH THE ANDRITZ-SEM DOUBLE WIRE PRESS FOR SLUDGE DEWATERING, PARTICU-LARLY IN THE PAPER, PULP AND BOARD IN-(ERFAHRUNGEN MOEGLICHKEITEN MIT DER ANDRITZ-SEM DOPPELSIEBPRESSE BEI DER SCHLAM-MENT-WAESSERUNG, INSBESONDERE IN DER PAPIER-, ZELLSTOFF-UND KARTO Maschinenfabrik Andritz A. G., Graz (Austria). For primary bibliographic entry see Field 5E.

ACTIVATED CARBON TREATMENT OF PULP AND PAPER WASTE WATER, Sumitomo Jukikai Envirotech, Inc. (Japan).

N. Mimoto, and M. Koseki. Japan Pulp and Paper, Vol. 13, No. 2, p 49-61, June, 1975. 27 fig, 13 ref, 6 tab.

Descriptors: *Pulp wastes, *Waste water treat-ment, *Activated carbon, *Tertiary treatment, Wastes, Waste treatment, Industrial wastes, Water pollution sources, Water pollution control, Water pollution treatment, Adsorption, Bleaching wastes, Costs, Properties, Pores, Distribution, Heat treatment, Foreign research, Water quality standards, Pulp and paper industry.
Identifiers: Deinking wastes, Japan, Kraft mills, Groundwood mills.

Primary and secondary treatment of pulp and paper waste waters (e.g., by activated sludge, sedi-mentation, and filtration) will have to be followed by tertiary treatment if the effluents are to meet water quality standards. Activated carbon treat-ment is suggested as the best tertiary method. This article reviews briefly activated carbon manufacture, carbon properties (pore size distribution) and other factors affecting adsorption, thermal process for regenerating the spent carbon, and test methods for determining the adsorption capacity. Activated carbon treatment of chemigroundwood. unbleached and bleached kraft mill effluents, kraft bleaching wastes (chlorination and extraction stage effluents), and deinking waste water are

discussed. The cost of carbon treatment in each uscussed. The cost of caroon treatment in each case is estimated. A method for scaling-up a laboratory carbon adsorption process to full-size operation is given. (Witt-IPC) W76-05730

SILVER IN PHOTOPROCESSING EFFLUENTS. Eastman Kodak Co., Rochester, N. Y.

C. C. Bard, J. J. Murphy, D. L. Stone, and C. J.

Journal Water Pollution Control Federation, Vol. 48, No. 2, p 389-394, Feb., 1976. 1 fig, 11 ref, 5 tab.

Descriptors: *Water pollution sources, *Waste water treatment, *Heavy metals, *Chemical wastes, *Photography, Wastes, Industrial wastes, Waste treatment, Water pollution control, Water pollution treatment, Metals, Biological treatment, Toxicity, Aquatic microorganisms, Sludge, Lake

Ontario.

Identifiers: *Silver, Silver compounds, Graphic arts industry, Silver sulfide, Genesse River(New York), Photographic film, Photographic paper.

Silver is generally solubilized as the tightly bound thiosulfate complex during processing of photographic paper and film. Data are presented show-ing that this silver-thiosulfate complex is not harmful to secondary waste treatment plants and is much less toxic than ionic silver to other aquatic organisms. The data show that silver thiosulfate in secondary biological waste treatment plants is degraded to insoluble silver sulfide, which is removed in the sludge. Thus, essentially all of the silver from photoprocessing is compatible with biological treatment. Analyses have shown that silver concentrations are not excessive in the Genesse River (New York) or Lake Ontario near Rochester, New York, despite a concentration of photographic manufacturing and processing facilities in this area. (Witt-IPC)

DISTRIBUTION OF LIGNIN IN WATERS OF THE LOURIZAN INLET AS A MEASURE OF CONTAMINATION DUE TO DUMPING OF LIGNOSULFONIC LIQUORS RESULTING LIGNOSULFONIC LIQUORS RESULTING FROM PRODUCTION OF CHEMICAL PULP (LA DISTRIBUCTION DE LA LIGNINA EN AGUAS DE LA ENSENADA DE LOURIZAN, COMOMEDIDA DE LA CONTAMINACION A CAUSA DEL VERTIDO DE LEJUAS LIGNINSULFONICAS, PROCEDENTES DE LA SULFONICAS, PROCEDENTES DE FABRICACION DE PASTA DE CELULOSA), For primary bibliographic entry see Field 5G.

PURIFICATION OF GUM ROSIN PRODUCING PLANT EFFLUENTS FROM RESINOUS SUB-STANCES (OCHISTKA STOCHNYKH VOD KANIFOL'NOTERPENTINNOGO PROIZ-VODSTVA OT SMOLISTYKH VESHCHESTV),

Tsentral'nii Nauchno-Issledovatel'skii i Proektnii Lesokhimicheskoi Promyshlennosti. Khimki (USSR9.

G. A. Ishcherikova, and N. P. Drozdov. Gidroliznaya i Lesokhimicheskaya Promyshlennost, No. 6, p 27-28, 1975. 2 ref, 4 tab.

Descriptors: *Waste water treatment, *Chemical Descriptors: "waste water treatment, "Chemical wastes, "Resins, "Neutralization, "Evaporation, Waste treatment, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Water pollution control, Calcium hydroxide, Resins, Hydrogen ion concentration, Water purification, Coagulation, Biological treatment, Chemical precipitation, Sodium compounds. Identifiers: Rosin, Sodium hydroxide, Sodium car-bonate, Calcium oxide, Calcium hydroxide, Aluminum sulfate, Iron sulfate, Oleoresins, Turpen-

In rosin-producing factories, smelted oleoresin along with turpentine, phosphoric acid, and water flows from the smelter to a decanter, where the

tine. Phosphoric acid.

mixture separates into two layers. The lower aqueous layer (effluent), containing resin, phosphoric acid, and oxidation products of rosin and turpentine, is settled in a separator. The resin separated is recycled, the precipitate formed is disposed of, and the aqueous layer is purified biologically. Frequently the aqueous layer has a high content of resin making it unsuitable for biochemical purifi-cation. A study was conducted to determine means of purifying the effluent from the decanter through neutralization and evaporation. Neutralization to a pH of 7-8 was done with NaOH, soda ash, milk of lime, and powdered calciumoxide. Evaporation was conducted until 90-95% effluent was distilled. Neutralization gave a 90-97% removal of resin, the best results being obtained with powdered calcium oxide. No additional purification was obtained by treatment of the neutralized effluent with coagulants, such as aluminum or iron sulfate. Evapora-tion gave a residue containing the bulk of organic substances, making the distillate suitable for biochemical purification. Either method can be recommended. In the neutralization method, the precipitate can be separated either on vacuum filters or by 24-hr sedimentation. The consumnTion of calcium oxide is 21 kg/cu m of effluent. (Stapinski-IPC)

BIOLOGICAL TREATMENT OF DYES,

Crompton and Knowles Corp., Worcester, Mass. R. H. Horning.

In: Book of Papers (Proceedings) National Technical Conference AATCC (American Association of Textile Chemists and Colorists), Oct. 15-17, 1975, Chicago, Illinois, p 354-358. 1 fig, 3 ref, 5 tab

Descriptors: *Activated sludge, *Dyes, *Waste water treatment, Biological treatment, Color, Biochemical oxygen demand, Nitrification, Fish, Toxicity, Waste treatment, Water pollution sources, Wastes, Industrial wastes, Water pollu-tion treatment, Water pollution control, Chemical Waste treatment, Water pollution

Of several dies introduced into an activated sludge pilot plant, none interfered seriously with the BOD-reducing performance of the units, although several interfered with nitrification. Per-centage color removal for 7 of the compounds exceeded 70%, but effluent color was reduced to less than 200 ADMI units for only three of the dyes. Fish toxicity of 6 dyes was substantially reduced by the bio-oxidation treatment. (Brown-IPC) W76-05737

TREATMENT OF DYE WASTES WITH GRANULAR ACTIVATED CARBON, P. B. DeJohn, and R. A. Hutchins

In: Book of Papers (Proceedings) National Technical Conference AATCC (American Association of Textile Chemists and Colorists), Oct. 15-17, 1975, Chicago, Illinois, p 327-344. 8 fig, 15 ref, 7 tab.

Descriptors: *Activated carbon, *Dyes, *Textiles, *Waste water treatment, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Water pollution control, Color, Lignite, Sorption, Waste treatment, Water quality control, Water nurification. Chemical wastes

Studies on the decoloring of textile dyeing effluents indicated that granular activated carbon (GAC) can sorb much of the colorants. Highmolecular dyes are adsorbed in the transitional pores, low-molecular compounds in the micropores of GAC preparations. Surface areas in micropores are drastically reduced upon thermal regeneration of GAC. The performance of reactivated carbons in adsorbing low-molecular dyes will be much poorer than for the original GAC, but equal or superior to virgin GAC in adsorbing highmolecular dyes. The properties of GAC from lig-nite are much less affected by regeneration than those of GAC from bituminous coal. These parameters should be taken into account in designation ning effluent-treating facilities. (Brown-IPC)

W76-05738

REHABILITATING AN 80-YEAR OLD SEWER SYSTEM,
Parsons, Brinckerhoff, Quade and Douglas, Inc.,

M. E. Stein, A. Alfaro, J. M. Grein, and I. V. Artale.

Public Works, Vol. 106, No. 12, p 61-62, December, 1975.

Descriptors: *Sewers, *Sewerage, Repairing, *Waste water treatment, *Sewage treatment, *Treatment facilities, Construction costs, Legisla tion. New York.

Identifiers: Rehabilitation, Storm sewers.

The City of Albany, New York, began rehabilitating its 80-year old sewer system in 1966 by forming the Albany County Sewer District which then purchased the existing treatment plant from the city. The plan was to replace the treatment plant with a new secondary waste water treatment plant and maintain the Hudson River Interceptor with 18 existing and three new sewage flow regulators. Finally, the City of Albany would separate its combined sewers of two districts. The rehabilitation program ran into problems. The existing regu-lators were inoperative out-of-date, and difficult to reach under city streets. During the installation of new equipment, old sewer lines could not be found, and when they were, they were found to be broken or incomplete. Redesigning storm sewers to eliminate street and basement flooding could not be paid for by the existing construction grants. Although the city did benefit by an exceptionally low bid for the first sewer district project, the estimated total cost to the city, minus grant funds, still amounted to \$14.5 million. In addition, from 1970 to 1975, the percentage of tax exempt properties rose from 48% to 68%. It was recommended in this report that this type of problem, which could be repeated throughout the country, be corrected by legislation. (Loustau-FIRL) 76-05764

PLASTIC PIPE, PRESSURE SEWERS, MARK EXPANSION.

Williams and Works, Grand Rapids, Mich.

T. C. Williams

Water and Wastes Engineering, Vol. 12, No. 11, p 85-87, November, 1975.

Descriptors: *Sewerage, *Plastic pipes, *Waste water treatment, Pipelines, Installation, Michigan, Treatment facilities

Identifiers: *Polyethylene pipes, *Pressure

Innovative use of polyethylene pipe and installation of grinder pumps and pressure sewers marked the expansion that doubled the treatment capacity of the lagoon and irrigation system in Harbor Springs, Michigan. This is the first known use of polyethylene pipe for a collection system and the first use of grinder pumps and pressure sewers in a collection system in the state of Michigan. To serve a resort area, flexibility of operation was necessary to cope with population fluctuations, and scenic qualities of the area had to be protected. The project eliminates discharge of septic tank and treatment plant effluent into several lakes and streams in the area. (Loustau-FIRL) W76-05765

WATER PURIFIED BY ELECTROFLOTATION FOR RAPID SEDIMENTATION AND CLEAN CLARIFIED WATER. French Patent FR 2256-903. Issued September 5, 1975. Derwent French Patents Abstracts, Vol. W,

No. 43, p D3, December 2, 1975.

Descriptors: *Patents, *Electrolysis, *Waste water treatment, *Bubbles, Treatment facilities, Equipment, Cathodes, Anodes, Flocculation, Sedimentation.

Group 5D-Waste Treatment Processes

Identifiers: *Electroflotation, Physico-chemical treatment

A newly patented electroflotation process for treating waste water consists of passing it through an electroflotation station where small bubbles of 02 and H2 are produced electrolytically. As these bubbles rise they trap solids held in suspension or in emulsion. Large solid particles should be broken up before treatment. Chemical flocculants may also be added during electrolysis. Another type of equipment for this process is one in which the electroflotation station has one or more electroly-sis grids, each with several spaced-apart anodes and cathodes. The latter process provides rapid sedimentation and is applicable to waters, such as those containing detergents, which are not easily purified by strictly biological methods. (Kramer-FIRL) W76-05766

FLOTATION PROCESS AND APPARATUS. Australian Patent 466,009. Issued October 16, 1975. The Australian Official Journal of Patents, Trade Marks, and Designs, Vol. 45, No. 38, p 4251, October, 1975.

Descriptors: *Waste water treatment, *Patents, Equipment, Oxygen, Bubbles, Liquid wastes, *Flotation, Gases, Separation techniques. Identifiers: Oxygen-free gas, Oxygen-bearing

A process for the simultaneous separation of insoluble materials and oxygen from a contaminated oxygen-bearing liquid has been patented. A constantly changing body of contaminated oxygen-bearing liquid is established at a predetermined level and maintained in an enclosed tank. An overlying freeboard space is also established and is closed to the atmosphere. A substantially oxyger-free gas is continuously introduced into the freeboard space. Draft means extend downwardly from the free board space into the liquid body. The oxygen-free gas is drawn by way of the draft means into the liquid where it is dispersed. The gas bubbles through the liquid floating contaminants to the surface of the liquid while also displacing oxygen from the liquid. The floated contaminants and some of the displaced oxygen are discharged from the freeboard space. The residual treated liquid is also discharged. (Orr-FIRL) W76-05767

BROOKLYN PLANT MEETS MAJOR CHAL-LENGES.

Hazen and Sawyer, New York. C. R. Walter, and J. Lastihenos. Water and Wastes Engineering, Vol. 12, No. 11, p 30-32, November, 1975. 1 fig.

Descriptors: *Waste water treatment, *Sewage treatment, *Treatment facilities, Biochemical oxygen demand, Suspended solids, Costs, Construction, New York. Identifiers: Renovation

The expansion of the Brooklyn, New York, 26th Ward Water Pollution Control Plant presented the challenges of limited site, close proximity to residences, and a short schedule. The purpose of the project was to increase the capacity of the existing plant from 60 to 85 mgd, and to increase BOD and suspended solids removal from 60% to greater than 90%. At the same time the plant was modernized, repaired, renovated, and, for systems that needed it, replaced. The total cost of the plant was approximately \$43 million. The chief features of the modernization and expansion of the plant were a new screen building, new raw sewage pumps, the demolition of grit chambers, and the conversion of an area into a service and storage building. Scheduling and cooperation among all contractors was extremely important under the conditions of this particular job. (Loustau-FIRL) W76-05768

AWT PLANT IS TOP PERFORMER,

Metcalf and Eddy, Inc., Boston, Mass. W. A. Peterson, and B. J. Sloan. Water and Wastes Engineering, Vol. 12, No. 11, p 49-51, November, 1975. 1 fig, 3 tab.

Descriptors: *Waste water treatment, *Chemical precipitation, *Tertiary treatment, *Aeration, Aluminum, Phosphorus, Nutrient removal, Eutrophiation, Sludge disposal, Construction, Costs, Treatment facilities, Massachusetts.

The new Marlborough, Massachusetts, Easterly Advanced Wastewater Treatment Plant upgrades the quality of the effluent discharged to the Sudbury River. In the past, major water problems were excessive levels of duckweed and algal blooms due to the high phosphorus content of the effluent. The new facility removes phosphorus by chemical precipitation with alum added in the first stage aeration tank effluent channel. Studies indicated that with an aluminum to inorganic phosphorus ratio of 2.1 to one, a mean final effluent total phosphorus concentration of 0.36 results. The corresponding orthophosphorous concentration was 0.11 mg/liter and the total phosphorous removal efficiency was 94%. Total nitrogen removal through the plant was typically found to be 45%. The unit operations of the plant include comminution, grit removal, primary settling, two-stage activated sludge, chemical precipitation of phosphorous, chlorine disinfection, reaeration, and vacuum filtration with sludge disposal to an on-site sanitary landfill. The total cost of the construction of the facility was \$6.2 million and the operating cost is 34 cents/1,000 gallons treated. (Loustau-FIRL)

PLANT PROTECTS A RECREATIONAL LAKE, Alley (E. Roberts) and Associates, Brentwood,

Tenn E. R. Alley.

Water and Wastes Engineering, Vol. 12, No. 11, p 69-71, November, 1975. 1 fig.

Descriptors: *Waste water treatment, *Treatment facilities, Tennessee, Construction, Sewerage, Biochemical oxygen demand, Eutrophication, Lakes, Recreation. Ammonia.

When the Radnor, Tennessee, Water District's Hurricane Creek Wastewater Treatment Plant was to be expanded from 175,000 gpd to 875,000 gpd, the State Department of Public Health established strict criteria to protect the eutrophying Percy Priest Reservoir. In addition, the existing plant had to remain in service during construction, the expansion contract had to be awarded to a contractor within three months of the beginning of design, and since the project was being financed by an industrial park, the construction cost had to fall within a strict budget. To meet the tight design and approval schedule, final plans and specifications were produced within six weeks, advertisement for bids lasted 30 days, and final award was given within three months. Final plans on portions of the project were drawn while preliminary approvals were being obtained on others. Fewer change orders were needed and the final cost was lower than the bid. Since January, 1975, the average effluent BOD has been 3.2 mg/liter; the effluent suspended solids, 8.7 mg/liter; and the effluent ammonia, 0.6 mg/liter, all well within the limits. The NH3-N has been consistently reduced to 0.5 mg/liter when the influent TKN has ranged from 20 to 34 mg/liter. The total construction cost for the plant was \$786,000. (Loustau-FIRL) W76-05770

REGIONAL PLANT TREATS SEPTIC WASTES, Boyle Engineering, Ventura, Calif.

Y. Katsura. Water and Wastes Engineering, Vol. 12, No. 11, p 81-82, 84, November, 1975. 1 fig, 1 tab.

Descriptors: *Waste water treatment, *Septic tanks, *Municipal wastes, *Treatment facilities, Chlorine, Liquid wastes, Costs, California

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The disposal of septic tank/cesspool and chemical toilet wastes had become critical in the area of Ventura, California, due to the inability of many local waste water treatment facilities to accept those wastes and the continued disposal of the wastes on fields and ravines. The chlorine sta-bilization process was selected for treatment of the wastes because of its ability to achieve liquid/solid separation along with stabilization. After concentration and separation, the solid fraction is trucked to landfill and the liquid fraction is piped to the ocean. The liquid waste processing capacity of the facility is 65,000 gpd. The process consists of a receiving station and wet well, a transfer station, a degritter, a solids balanc-ing/storage tank, solids feed pumps, solids conditioning units, solids concentration and decant storage ponds, an effluent pump station, a decant neutralization facility, and appurtenant support facilities. To stabilize the liquid waste, several factors had to be balanced, including chlorine dosage and percent solids of feed. The next critical step was solids concentration for which a unique de-canting method produced a solids concentration of 17.8%. The total cost of the facility was \$950,000, of which about 87% was paid for by federal and state grants. (Loustau-FIRL)

SUPERNATANT DOESN'T HAVE TO RUIN EF-

FLUENT QUALITY,
Jones and Henry Engineers, Ltd., Toledo, Ohio. F. F. Sampayo.

The American City and County, Vol. 90, No. 11, p 52-53, November, 1975. 1 tab.

Descriptors: *Waste water treatment, *Activated sludge, *Odor, Biochemical oxygen demand, Costs, Effluents, Filtration, Suspended solids,

Identifiers: Ammonia stripping, *Supernatants.

In order to produce high-quality effluents, a new method for treatment of supernatant and filtrate is being tried in Pontiac, Michigan. The process ammonia under high temperature and pH conditions while minimizing chemical require-ments and unpleasant odors of ammonia. By this process BOD and suspended solids loading on the plant processes are also reduced. The ammonia stripping tank is a 12-ft diameter, 18.5-ft high fiberglass tank equipped with a bottom air header and diffusers. The tank is totally enclosed to eliminate stray ammonia odors. The process should reduce the NH3-N concentration in the recycle streams to 100 mg/liter or less, as well as remove substantial amounts of BOD and suspended solids. Air requirements for the activated sludge process can be reduced and a more stable plant operation is possible. The cost for power for stripping the ammonia is minimal. (Loustau-FIRL) W76-05772

MUNICIPAL WASTEWATER ODOR STILL A PROBLEM--PART 1, Pennsylvania State Univ., University Park.

W. J. Hartman, and D. A. Long. Water and Sewage Works, Vol. 122, No. 12, p 38-41, December, 1975. 2 fig.

Descriptors: *Odor, *Municipal wastes, *Waste water treatment, Waste water disposal, Air pollu-tion, Anaerobic treatment, Industrial wastes,

Odors associated with collection, transport, treatment, and disposal of sludge and waste water ef-fluents are a form of air pollution related to mu-nicipal waste water treatment. Odors can come from the vapors and gasses produced by the anaerobic decomposition of compounds, or they can be the result of chemicals in industrial waste. Algae, an important waste stabilizer, can also be a source of odors. Preventing water from stagnating and skimming algal overgrowth are two solutions to the problem. Careful separation of solids is another minimizing solution. Two other problems related with municipal waste water, insect breeding and pathogen dissemination, are also discussed. (Loustau-FIRL) W76-05773

POND AND IRRIGATION SYSTEMS OFFER ECONOMY AND FLEXIBILITY, William and Works, Grand Rapids, Mich.

Water and Sewage Works, Vol. 122, No. 12, p 44-45, December, 1975.

Descriptors: *Oxidation lagoons, *Waste water treatment, *Irrigation, Waste water disposal, Crop production, Capital costs, Economics. Identifiers: Oxidation ponds, Spray irrigation.

Oxidation pond and irrigation waste water systems, especially suited for small communities, are 'natural' systems requiring little maintenance. The oxidation ponds or stabilization lagoons need to be checked once a day. The irrigation system is usually one of three systems: spray, flood, or ridge and furrow. The spray system with center pivot equipment is the most widely used in the United States. Crops ranging from alfalfa to Christmas trees are often grown in conjunction with the irrect are often grown in conjunction with the irrigation system. An especially attractive feature of pond and irrigation systems is that they can be developed in stages with low initial costs. (Loustau-FIRL) W76-05774

PHOSPHORUS REMOVAL FROM STATIC SEWAGE EFFLUENT USING DUCKWEED, Agricultural Research Center, Fort Lauderdale,

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D. L. Sutton, and W. H. Ornes. Journal of Environmental Quality, Vol. 4, No. 3, p 367-370, September, 1975. 4 fig, 1 tab, 12 ref.

Descriptors: *Sewage effluents, *Nutrient removal, *Waste water treatment, Phosphorus, Effluents, Aquatic plant, Tertiary treatment, *Sewage treatment.

Identifiers: *Duckweed, *Phosphorus removal.

Aquatic macrophytes have been used to remove nutrients from sewage effluents. In this case, duckweed (Lemnaceae family) was suggested for the removal of phosphorus and experiments were conducted to determine the amount of plant material and length of time necessary to reduce the nutrient level in enriched water. The level of production of plants that could be expected when plant are harvested was also investigated. A mixed population of duckweed was grown for two weeks in 12 liters of 16, 12, and 25% concentrations of secondary treated sewage effluent; the dry weights of these plants were 16, 23, and 31% higher than plants grown in pond water. Over 90% of the phosphorus in the sewage effluent was removed by the duckweed during the first four weeks of an eight week period; during the second four weeks removal was slow. For the whole period, the phosphorus content of the sewage effluent was reduced from 2.67 to 0.08 micrograms/ml, a 97% decrease. The conclusions of the study were that duckweed could be used to reduce levels of phosphorus in sewage effluent held under static conditions. The removal rate depend upon the amount of duckweed, concentration of phosphorus in the effluents, and length of contact time. (Kramer-FIRL)

PROCESS BIODEGRADABLE EFFLUENT UN-

DERGROUND. Processing, p 33, September 1975. 2 fig.

Descriptors: *Biological treatment, *Waste water treatment, *Aeration, Activated sludge, Biodegradation, Costs, Environmental effects. Identifiers: *Deep shaft aeration process.

One of the few 'spin-off' technique effluent treat-ment operations is the ICI Deep Shaft Aeration Process at Billingham. The process is a combinasystems located in a mined shaft hundreds of feet deep. Because of the pressure resulting from the great depth of the shaft the air bubbles disappear before reaching the bottom of the shaft, and all the dissolved oxygen is available to the process, thus reducing the normal retention time from 12 hours to 2 hours. The biodegradable effluent and microorganisms are circulated by compressed air until the biological oxidation is complete, when it overflows by gravity for solids separation. Some of the advantages over conventional systems are 50% land saving due to eliminated settling stage, 50% less sludge production, low capital and operating costs and minimal environmental im-pact. (Loustau-FIRL) W76-05776

WASTEWATER RENOVATION AND REUSE:AN URGENT ENVIRONMENTAL NEED

Compost Science, Vol. 16, No. 5, p 26-27, Au-

Descriptors: *Waste water treatment, *Recycling, *Water reuse, Industrial wastes, Sludge disposal, Conferences, Waste water disposal.

Thirteen recommendations were made by the International Conference on the Renovation and Recycling of Wastewater Through Aquatic and Terrestrial Systems. The representative scientists from nine countries at the July, 1975, meeting exchange information on reuse technology, discussed the possibilities of use of waste water, and examined the social impacts of waste water reuse in various countries. They then drew up the program of recommendations which included the demand for all varieties of industrial waste, the recommendation that no sludge be used resulting in direct human consumption, and the request that detailed consideration be given to the actions of heavy metals, biocides, teratogens, carcinogens, mutagens, and all varieties of pathogens. (Loustau-FIRL)

MUNICIPAL PLANT HANDLES 44% PULP AND PAPER MILL WASTES,

H. G. Swope. Water and Sewage Works, Vol. 122, No. 12, p 61, December, 1975

Descriptors: *Pulp wastes, *Sewage treatment, *Municipal wastes, Pulp and paper industry, Wisconsin, *Treatment facilities, Operating costs, Incineration, Biological treatment.
Identifiers: *Municipal-industrial wastes, Joint

The Green Bay Sewage Treatment Plant is the first plant in Wisconsin that handles municipal sewage containing 44% pulp and paper mill wastes. The plant, which represents a partnership of public and private sector was designed to meet the districts private sector was designed to meet the districts projected waste water treatment needs until at least 1990. The operating costs of the facility will be \$1 million annually. The sewage at the Green Bay plant undergoes mechanical treatment, biological treatment, and solids processing. The sludge is incinerated and the ash deposited as landfill. As of the end of 1975, part of the facility was to cost approximately \$72 million and was designed to handle a peak flow of 171 mgd. (Loustau-FIRL) W76-05778 TORONTO'S APPROACH TO PREVENTIVE MAINTENANCE FOR TREATMENT PLANTS, Metropolitan Toronto Dept. of Works (Ontario). Water Pollution Control Div. For primary bibliographic entry see Field 5F. W76-05780

OPERATIONAL PRACTICES TO UPGRADE TRICKLING FILTER PLANT PERFORMANCE, Henningson, Durham and Richardson, Inc., Omaha, Nebr.

.. E. Shriver, and D. M. Bowers

Journal Water Pollution Control Federation, Vol. 47, No. 11, p 2640-2651, November, 1975. 9 fig. 2 tab. 9 ref.

Descriptors: *Trickling filters, *Waste water treatment, Biological treatment, Clarification, Coagulation, Treatment facilities, Filtration. Identifiers: Alum, Chemical treatment.

An investigation of trickling filter plant per-formance was conducted to discover the reasons for clarifier inefficiencies in winter and to find ways to improve effluent quality in winter. Samples of final effluent were tested and chemical coagulation was done by jar tests at typical winter-time temperatures. Of the various chemical coagulants tested, detailed reports on the coagulant alum were made because of reports of success at many treatment plants. It was found that the terminal settling velocity of a particle with a given size and density decreases with a decrease in temperature. Adding alum to the trickling filter effluent upgraded plant performance and increased sludge volumes, but digester operation must be watched more closely. Several recommendations for improving plant operation in winter were made. Waste water temperature variations should be considered in final clarifier surface loading design. When adding chemicals, mixing, recirculation flows, freezing, and corrosion are important considerations. Separate chemical treatment for digester supernatant and/or high-strength in-plant waste streams should be considered at plants in which the impact of this waste is significant. (Loustau-FIRL) W76-05781

ANAEROBIC DIGESTION: THE RATE-LIMIT-ING PROCESS AND THE NATURE OF INHIBI-

Drake Univ., Des Moines, Iowa. Dept. of Physics. C. D. Finney, and R. S. Evans. Science, Vol. 190, No. 4219, p 1088-1089, December 12, 1975. 1 fig., 1 tab., 21 ref.

Descriptors: *Anaerobic digestion, *Waste water treatment, *Bacteria, Methane, Carbon dioxide, Kinetics, Design criteria, *Inhibition.

Anaerobic digestion would hold much greater promise if faster processes could be developed. One hypothesis is that the transfer of acetic acids by methanogenic bacteria into methane and car-bon dioxide gases is rate-limiting, and that the nor-mal metabolic activity of the methanogenic bac-teria is inhibited by product gases. It is possible that at very high substrate concentrations gas bubbles actually surround a bacterium, interfering with substrate diffusion into intracellular spaces. An experiment for determining the kinetic parameters of the methanogenic bacteria in a highly mixed, low-pressure environment, resulted in improved gas transfer characteristics in the region of the bacterial cell wall. The indication is that faster, more efficient anaerobic digesters might be developed. Design specifications for faster systems might include vigorous agitation, low pressure, and elevated temperatures. (Loustau-FIRL) W76-05784

LIME RECOVERY AND REUSE IN PRIMARY

TREATMENT, Brown and Caldwell, Walnut Creek, Calif.

Group 5D-Waste Treatment Processes

D. S. Parker, G. A. Carthew, and G. A. Horstkotte. Journal of the Environmental Engineering Division Proceedings of ASCE, Vol. 101, No. EE6, p 985-1004, December, 1975. 8 fig, 7 tab, 7 ref.

Descriptors: *Waste water treatment, *Lime, *Recycling, California, *Water reuse, Monitoring, Design, Sampling, Treatment facilities, *Water treatment Identifiers: Unit processes.

The lime recovery and reuse study, part of the research undertaken by the Central Contra Costa Sanitary District of California, was conducted in order to provide design and operating data on the various unit processes being designed for the district's new water reclamation plant. The study investigated the solids processing and recycling operations and monitored the performance and interaction of the individual unit processes under recycle conditions. Sampling and analysis of the constituents of each stage of the solids processing system allowed determination of amounts of calcium, magnesium, phosphorus, iron, silica, availa-ble lime, total solids, and loss on ignition. Daily logs were devised so that, along with laboratory data, calculations could determine the performance of the recycle process. It was found from the investigation that recalcined lime performed better than the virgin lime in primary treatment applications. Calcium carbonate and, to a greater extent silica, are classified into the cake in the wet classification process. Recalcination efficiency was dependent on recalcination tempera-ture. A rejection of 24% of the silica, while recovering 98% of the calcium oxide, is possible in the dry classification process. Mass balances for the full-scale system indicate that 62% recycle of lime is possible while keeping recycled solid loads at reasonable levels. (Loustau-FIRL) W76-05785

LOW COST PHOSPHOROUS REMOVAL,

L. E. Peirano.

Water and Sewage Works, Vol. 122, No. 11, p 58-59, November, 1975

*Activated sludge. Descriptors: *Chemical precipitation, *Waste water treatment, Nutrient removal, Phosphorus, Equipment, Costs, Biological treatment, Nevada, *Operating costs.

Identifiers: *PhoStrip process, *Phosphorus

The PhoStrip process was studied in a plant-scale test at the Reno-Sparks Joint Water Pollution Control Plant that treats approximately 6 mgd of domestic waste water. The PhoStrip process utilizes activated sludge microorganisms to concentrate phosphorous from the waste water flow stream into a smaller stream from which the phosphorous is removed by chemical precipita-tion. The major difference between the PhoStrip process and other biological processes for phosphorous removal is the use of a separate phosphorous stripping tank where phosphorous release is induced and controlled. An equation for phosphorous removal efficiency is given as E=100-130 to the (1.85-P) power, where E stands for phosphorous efficiency and P stands for a composite parameter. During the study it was noted that the PhoStrip process produced more stable sludge than conventional systems, and that it had no significant effects on BOD or suspended solids removal or on aeration air requirements. The PhoStrip was also less affected by shock loads because of the offstream reservoir of activated sludge provided by the stripping tank. The system did produce more froth than the conventional old produce more from than the conventional system, and some odor emanated from the stripping tank. The PhoStrip process achieved greater than 90% removal of phosphorous, and at the Reno-Sparks plant will save an estimated \$600,000 to \$800,000 annually in operation and maintenance costs. (Loustau-FIRL)

COMBINED WASTE TREATMENT PROVES ECONOMICAL AND FEASIBLE,

Whitman and Howard, Inc., Boston, Mass. J. T. Hannigan.

Water and Sewage Works, Vol. 122, No. 11, p 38-41, November, 1975. 1 fig, 3 tab.

Descriptors: *Pilot plants, *Food processing industry, *Waste water treatment, Municipal wastes, Tertiary treatment, Treatment facilities, Biochemical oxygen demand, Massachusetts, Economics, Feasibility.

Municipal-industrial Identifiers: *Combined treatment.

Results of a pilot plant study have shown that combined treatment of domestic waste and industrial cranberry waste is the most economical way to treat both waste waters in the town of Mid-dleborough, Massachusetts. The municipal plant presently treats the cranberry industry's waste, but due to plant expansion, population growth, and equipment wear, a new treatment facility is necessary. The study showed that the cost of constructing a tertiary treatment facility to handle both domestic and industrial cranberry waste is almost 1.5 million dollars less than the cost of a tertiary treatment facility for the domestic waste water alone. The results of the study also showed that the cranberry waste is substantially biodegradable and the mixture of both domestic and industrial resulted in the BOD rate constant approaching that of the cranberry facility's waste water alone. Biological treatment of the combined wastes, in which the domestic wastes will take advantage of the nutrient deficiencies of the industrial waste, should achieve excellent BOD removal as well as a reduction in the overall phosphorus and ammonia nitrogen concentration. The proposed facility will include a pretreatment facility, two primary clarifiers, four aeration tanks, two secondary clarifiers, a post chlorination detention tank, a sludge handling and chlorination building, a sludge holding tank, a new control building, two rapid sand filters and a post aeration tank. Construction of the project, estimated to cost \$4.5 million, began in 1975 and is projected to be completed in 1977. (Loustau-FIRL)

CROSS-FLOW FILTRATION AND AXIAL FIL-TRATION, Oak Ridge National Lab., Tenn.

K. A. Kraus. In: Proceedings of the 29th Industrial Waste Conference, Part Two, May 7-9, 1974, Lafayette, Indiana, Purdue University, p 1059-1075. 13 fig, 3 tab,

Descriptors: *Filters, *Filtration, *Waste water treatment, Effluents, Colloids, Design, Equipment, Analytical techniques, Separation techniques, Centrifugation, Energy, Economics. Identifiers: *Axial filtration, *Cross flow filtra-Separation tion, Particulate matter, Flux decline.

Increasing effluent standards are making presently adequate treatment methods unsatisfactory. Alternative, more efficient solid-liquid separation techniques are needed. Two novel forms of filtration, cross-flow filtration and axial filtration, are discussed. Cross-flow filtration is the technique whereby the feed solution is rapidly pumped past the filtering solution at right angles to product flow. Cross flow filtration is carried out at low pressures and deals with the removal of particulates and colloids, and so must be differentiated from hyperfiltration and ultrafiltration. Axial filtration depends on the idea that pumping a solution past a filter is no different from passing a filter through a solution. The filter rotates about a hollow cylinder and, at high rotational velocities, filtration is augmented by high centrifugal forces. Various design options for the two types of filter are discussed. Axial filters can be used in different modes of operation, depending on the rotational velocities. The object of both types of filtration is to produce flow speeds such that the flux decline as a function of time is arrested. A mathematical analysis of flux decline is presented. An economical analysis of the filters is given. For cross-flow filters, energy requirements per unit product are filters, energy requirements per unit product are inversely proportional to production rate for a constant cross-flow velocity. For a constant energy consumption, cross-flow velocities increase with production rate. Axial filters can become uneconomical when dealing with extremely small particles, since very high rotational speeds are required to arrest flux decline. Various applications of these desires as illustrated from the first decline. tions of these designs are illustrated. (Pinto-FIRL) W76-05788

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TERTIARY TREATMENT PLANT FOR MULTISTORIED BUILDING,

Dorr-Oliver (India) Ltd., Madras.

K. N. Savalappan.

Journal of the Institution of Engineering (India), Vol. 55, Part PH3, p 81-84, June, 1975. 1 fig, 2 tab.

Descriptors: *Treatment facilities, *Tertiary treatment, *Waste water treatment, Activated sludge, Sewage, Aeration, Effluents, Buildings, Water reuse, Biochemical oxygen demand, Separation techniques, Costs. Identifiers: Mu

Multistoried buildings, bay(India), *India.

Modern technology has resulted in large concentrations of people in India and, consequently, an increase in the number of multistoried buildings. Bombay, which contains many of these buildings, has an acute water scarcity. Tertiary treatment, which makes sewage fit for reuse, is discussed as a technique to increase the water supply for multistoried buildings. Water is lost through domestic use and, although water used for air conditioning units can be reused after cooling, a certain amount is lost through evaporation. Tertiary treatment plants were installed to make toilet water fit for reuse as cooling water in air condi-tioning units. A flow sheet of a tertiary treatment plant is illustrated. Sewage is brought from the building and large floating matter is filtered with a bar screen. The activated sludge process is used in the aeration tanks to purify the raw sewage. The biochemical oxygen demand of the effluent from this tank is monitored. The aerated sewage flows into a clarifier where the biological solids are separated and returned to the aerator. Coagulants are added and the effluent is flocculated and further clarified. The effluent undergoes rapid sand gravity filtration and is softened in a regeneration unit by means of a cation exchange process. The final step is chlorination, to prevent algal growth. Costs may vary over a considerable range, but the apparatus, methods and processes exist to produce water of virtually any purity required. (Pinto-FIRL) W76-05789

CONVERTING SEWAGE INTO SAVINGS. Chemical Week, Vol. 118, No. 2, p 47, January 14,

*Tertiary treatment, Descriptors: *Operating costs, *Recycling, Ammonia, Fertilizers, Treat-ment facilities, *Waste water treatment, *Sewage treatment, California, Nevada.

Identifiers: *Ammonium sulfate fertilizer, Clinop-tilolite, *Ammonia removal and recovery process(ARPP), Lake Tahoe(Nevada-Calif).

Producing ammonium sulfate fertilizer will help defray the operating costs of a new tertiary treatment plant being built on Lake Tahoe. The ammonia removal and recovery process produces 40% concentration ammonium sulfate solution from the regeneration stream from the plant's ammonia-stripping ion-exchange beds. The solution contains about 9% available nitrogen, suitable for direct irrigation of sprinkler system application by farmers or for blending by commercial fertilizer manufacturers into ammonium sulfate. The North

Lake Tahoe plant will produce between 2.5 and 5 tons of fertilizer per day. The cost of installing the process is about 10% of the total construction cost of the new plant, but the designers say the sale of fertilizer materials will cut operating expenses by 60%. Ammonia is removed from the waste stream by passing over a bed of clinoptilolite. The bed is then flushed with a concentrated sodium chloride solution which 'bumps' the ammonia ions into a regeneration solution. With an ammonium concentration of about 300 ppm, the solution is pumped into clarifiers where sodium hydroxide is added to convert the ammonium ions into ammonia gas. In an absorption tower the gas is converted into a 40% solution of ammonium sulfate. The ammonia 40% solution of ammonium sulfate. The ammonia removal and recovery process is part of a \$20 million waste treatment system that includes pure-oxygen-activated sludge treatment, two-stage lime addition for the removal of phosphorus, dual-media filtration, activated carbon adsorption, ionexchange for ammonia removal, and chlorination for disinfection. (Loustau-FIRL)

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BIOLOGICAL DENITRIFICATION AND ITS APPLICATION IN TREATMENT OF HIGH-NITRATE WASTE WATER, Oak Ridge National Lab., Tenn. Environmental

Sciences Div.

C. W. Francis, and M. W. Callahan.

Journal of Environmental Quality, Vol. 4, No. 2, p 153-163, April/June, 1975. 2 fig, 1 tab, 82 ref.

Descriptors: *Denitrification, *Biological treatment, *Anaerobic conditions, Activated sludge, *Nitrates, Industrial wastes, Fertilizer, *Waste water treatment, Cations.

One of the most effective denitrification processes is biological denitrification in which nitrates are converted to nitrogen by microorganisms respiring under anaerobic conditions. The optimum condi-tions for maximum denitrification include a hydrocarbon for additional cell synthesis, a pH in the range of 7.5 to 8.5, and a temperature range of 45 to 60 C. The modified activated sludge reactor is one basic design that has been developed and tested for denitrification. In this system long re-sidence times are required to prevent loss of microbial mass through washout. Another design, the packed-bed reactor, provides surface area for microbial growth which reduces washout and increases cell concentration. When large flow rates are required, biomass accumulation in the bed in-creases head loss, and then maintaining a pumping system becomes a problem. Large head losses are an even greater problem in anaerobic columns in which the flow is operated in a downward mode. Although upward flow columns resemble packedbed reactors, they contain a much lower pore space than the packed-bed reactor. The engineer-ing design used for biological denitrification of nitrate wastes will depend on the dominant com plementary and associated cations in the waste. Anaerobic columns appear to be the most effective method for the treatment of nitrate wastes as sociated with fertilizer and uranium oxide fuel fabrication plants. (Loustau-FIRL) W76-05792

QUEBEC'S WATER AND SEWAGE MASTER-PLAN FOR MIRABEL REGION.

Water and Pollution Control, Vol. 113, No. 12, p 38, December, 1975. 1 fig.

Descriptors: *Water pollution control, *Waste water treatment, *Sewage treatment, Treatment facilities, *Airports, Costs, Administration, *Regional development, Canada, Comprehensive

Identifiers: Quebec, *Montreal(Mirabel Int'l Air-

Because it is predicted that the population around Montreal's Mirabel International Airport will triple within the next 25 years, a masterplan for

water distribution and treatment in the area sur-rounding the airport has been drawn up and released. The plan divides the area into three re-gions and advises expansion of some existing facilities and construction of some new facilities Federal and provincial authorities will provide the funding for each municipality, but there is no presrunding for each municipanty, but there is no pres-sure to comply with the masterplan. The only part presently under construction is the sewage treat-ment plant for the airport and the adjacent indus-trial park, but its facilities will not be used by the municipalities. The total projected construction costs for the regional distribution and treatment plants is approximately \$114 million. (Loustau-W76-05793

EDINBURGH'S SEWAGE-TREATMENT AND DISPOSAL SCHEME,

Edinburgh Corp., (Scotland).

J. Dugdale. Water Pollution Control, Vol. 74, No. 6, p 611-624,

1975. 9 fig, 1 ref.

Descriptors: *Sewage disposal, *Waste water treatment, Construction, *Treatment facilities, *Outfalls, Sewerage, Construction, Waste water disposal, Waste disposal. Identifiers: *Scotland(Edinburgh).

Because of the recent emphasis on improvement of sewage disposal methods, a scheme for improvement of existing facilities was presented to the City of Edinburgh. A number of the aspects of the scheme were investigated and then final ap proval was given to the scheme in the beginning of 1971. Construction should be completed by the middle of 1976. The existing sewage disposal was done via nine main outfall sewers distributed over 14 km of the city's coastline. The scheme proposed to redirect all the sewage flow to a central point in an interceptor sewer system where primary treatment would be carried out followed by discharge through a sophisticated outfall to the Estuary and disposal of sludge in the sea. The out-fall area was studied for current direction and velocity over a wide range of tidal and wind condi tions. The raw sludge disposal area in the sea is about 25 km offshore and a tanker for carrying the sludge is under construction. Almost half of the studge is under construction. Almost hair of the total 15.8 km of interceptor sewer system is already completed. The site of the sewage treatment works was chosen to be the Estuary which required land reclamation. The extent of reclamation was about 22 ha, of which 11.8 ha is for the primary treatment works, and the rest is for future expansion. The sewage treatment works include preliminary treatment, primary treatment, storm-sewage treatment, and sludge storage. The current total estimate of cost of the whole scheme is L22 million, of which almost half is for interception and redirection of sewage. A survey of the biologi-cal habitat along a 19 km length of coastline around the city is being conducted before and after operation of the new treatment scheme. (Loustau-W76-05794

FACTORS IN THE PURIFICATION OF FLOW-ING SEWAGE AND ACTIVATED SLUDGE PROCESS, PART I, Indian Inst. of Science, Bangalore. Dept. of

S. C. Pillai, E. G. Srinath, C. V. Viswanathan, B. Merra Bai, and G. Kasi Viswanath. Water and Waste Treatment, Vol. 18, No. 9, p 36, 38, 40, 42, 44, September, 1975. 18 fig, 4 tab.

Descriptors: *Activated sludge, *Sewage treatment, *Sewerage, *Protozoa, Alkalinity, Turbidity, *Waste water treatment, Water analysis, Asia, ater purification. Identifiers: *India

Because little is known about the purification of sewage in running water, a study was made of the

sewage system of Bangalore in which waste water flows through channels to tanks 10 and 25 miles from the city. Samples of sewage were collected from the longest channel which carries daily about 14 million gallons of sewage and has a general gradient of about 1/100. The velocity of the channel water varied from 2 to 8 feet per second. Anal-ysis of the samples of sewage that had traveled about 7 miles in 4 to 6 hours revealed that turbidity values, bacterial count, catalase activity, oxidiza-ble organic matter, BOD, ammoniacal nitrogen, water soluble phosphorus, total phosphorus, and fatty matter had been reduced to the point at which the water could be considered purified. The alkalinity of the same sewage was not comparably reduced and the reason for this is not clear. A test was then conducted to study the influence of turbulence in the running water purification system. Hourly analyses of samples taken for 24 hours did not show any appreciable purification. A test of the growth of protozoa in raw sewage and boiled sewage showed that when protozoan growth was sewage showed that when protozoan growth was about 20%, purification was appreciable; when protozoan growth was less, purification was negligible. A test comparing the technique of fluidization with the activated sludge process was conducted, producing equal results. The experiments not only establish the role of protozoa in sewage purification, but also indicate the possibility of improving the activated sludge process. (Loustau-FIRL) W76-05795

MINIMAL COST PLANT CLEANING UP HAR-BOR.

Albertson, Sharp and Backus, Norwalk, Conn E. Backus

Water and Wastes Engineering, Vol. 13, No. 1, p 16-17, 43, January, 1976. 3 fig, 1 tab.

Descriptors: "Waste water treatment, "Treatment facilities, "Sewage treatment, Construction, Suspended solids, Biochemical oxygen demand, Connecticut, "Operating costs. Identifiers: Norwalk(Conn).

During the first four months of operation of the Norwalk, Connecticut, new waste water treatment plant, average removals of 90% suspended solids and 86.8% BOD5 were achieved. Secondary treatment begins as the effluent from the primary settling tanks enters the aeration tanks and flows through secondary settling tanks to a chlorine con-tact tank. Sludge removed from the secondary tanks is returned to the aeration tanks or wasted to a splitter box which can divide the sludge among one to three flotation thickeners. Sludge from the thickeners is concentrated in a Dorr-Oliver tray thickener, and then pumped to a group of four centrifuges. This plant varies from conventional systems in the details of construction rather than in the basic flow pattern. Each of the aeration tanks can be fed in homogeneous, step, or plug flow. The secondary settling tank overflow arrangement is a unique system of fiberglass collecting launders which may be placed anywhere in the last half of the tank where the greatest clarity is observed. An old abandoned, primary digester tank was used to house the new main electrical substation equipment. The plant is located on a 28 acre site much of which used to be flooded at high tide. The plant grade was raised to a level higher than the flood stage of the 1938 hurricane by ad-ding 150,000 cu ft of fill. The fill was obtained from Norwalk's incinerator landfill site which needed more capacity. A stone-faced revetment, with a slope of one on eight, was constructed to retain the landfill. (Orr-FIRL) W76-05796

AUTOMATION CAN BE SIMPLE.

R. J. Martin.

Water and Wastes Engineering, Vol. 13, No. 1, p 31, 42, January, 1976. I fig, I tab.

Group 5D—Waste Treatment Processes

Descriptors: *Waste water treatment, *Treatment facilities, *Automatic control, *Automaticn, Control systems, Instrumentation, Equipment, Sewage treatment, Costs, New York.

An automatic system based on the application of simple electro-mechanical controllers has been on stream for over three years in two waste water treatment plants in Sheburne and Alfred, New York. The system comprises an electro-mechanical controller that energizes circuits which provide automatic control for the routine operations of drawing supernatant and pumping sludge and scum. The stepping drum controller initiates a sequence of opening and closing valves, and starting and stopping pumps, heater, mixer and sludge collectors. Each step is actuated by a signal in-dicating that the preceding step is finished. A malfunction in any step will return all the units to the 'at rest' mode and actuate alarm lights and/or audialarms. The drum will remain at the step on which the malfunction occurred, permitting the operator to easily determine the type of malfunction. The controller includes: a perforated aluminum drum, step-driven by an electric motor; a series of roller-lever-actuated snap-action switches; terminal strips for input and output connections; and, control circuitry for the drive motor. Points around the circumference of the drum correspond to the steps of the treatment program while points along the axis of the drum cor-respond to individual control outputs. The system was installed in each plant for about \$25,000. (Orr-FIRL) W76-05797

THIS PLANT CAN USE 5 SLUDGE PROCESSES,

Rist-Frost Associates, Glens Falls, N. Y. Dept. of Environmental Engineering. M. Vonic.

Water and Wastes Engineering, Vol. 13, No. 1, p 26-28, January, 1976. 4 fig, 1 tab.

Descriptors: *Waste water treatment, *Activated sludge, *Control systems, *Treatment facilities, Flow, Temperature, Costs, New York, Suspended solids, Biochemical oxygen demand, Recreation, *Sludge treatment.

The new 2 mgd waste water treatment plant designed for the Village of Saranac Lake, New York, is capable of maintaining between 90% and 96% BOD and suspended solids removal despite substantial fluctuations in waste water flow due to a large summer tourist population. The plant can be operated with five different types of activated sludge processes which permits the operator to produce a high quality of effluent even though the flow and temperature vary considerably. During 1974, the plant operator was able to achieve a consistently high plant performance with an average of 92% BOD and suspended solids reduction, using only half of the available biological reactor capacity. The main sludge process utilized during this period was 'two stage'-'step feed.' The food to microorganism ratio (F/M) was maintained between 0.2 and 0.4; the sludge age varied between four and eight days, average age was five days. A mixture of raw and waste activated sludge is thickened in a gravity sludge thickener and then pumped to the primary heated digester. The use of a thickener has reduced the cost of heating the sludge for digestion. The total cost of the facilities was about \$2 million. (Orr-FIRL)

AERATED LAGOONS SOLVE TOWN'S SITE PROBLEMS.

Burns and McDonnell, Kansas City, Md. W. E. Goodnow.

Water and Wastes Engineering, Vol. 13, No. 1, p 40, January, 1976. 1 fig.

Descriptors: *Waste water treatment, *Sewage treatment, *Aerated lagoons, *Aeration, Equip-

ment, Cleaning, Pipes, Oxygenation, Lagoons, Missouri, Oxidation lagoons. Identifiers: *Oxygen transfer.

Lee's Summit. Missouri, has installed two agrated lagoons at its Vale Treatment Facility. They have a combined volume of 92.8 million gal. The lagoon bottoms and dikes were constructed of compacted earth and no liners or sealer were required. The aeration system is 7,300 feet of plastic header pipe carrying air supplied by three 30-hp Roots positive displacement blowers operating simultaneously to deliver 595 cfm each of six to seven pounds pressure. 84,500 feet of Air-Aqua aeration tubing creates a pattern of 168 aeration cells. Openings in the tubing release a constant stream of small air bubbles which form linear screens dividing the lagoons into separate treatment cells, mixing the liquid contents, and efficiently transferring oxygen. Effluent dissolved oxygen measurements are consistently greater than 4 ppm. Three cleanings/year are required for the aeration system to remove the carbonate deposit buildups around the aeration tubing outlets. Anhydrous HCl gas is used for cleaning. The gas hydrolyzes into an acid upon contact with water and dissolves the deposits of calcium and magnesium carbonates. (Orr-FIRL) W76-05799

BIOLOGICAL NITRIFICATION OF SLUDGE SUPERNATANT BY ROTATING DISKS,

Metropolitan Sanitary District of Greater Chicago, Ill. Dept. of Research and Development.
C. Lue-Hing, A. W. Obayashi, D. R. Zenz, B. Washington, and B. M. Sawyer.
Journal Water Pollution Control Federation, Vol. 48, No. 1, p 25-46, January, 1976. 11 fig, 10 tab, 9

Descriptors: *Waste water treatment, *Nitrification, *Biological treatment, Ammonia, Nitrogen, Illinois, *Sludge treatment, Denitrification.

Identifiers: *Rotating disk system, *Chicago(III), Ammonia nitrogen, *Sludge lagoon supernatants.

In its search to find a practical method of reducing the ammonia nitrogen content of its sludge lagoon supernatant (SLS), the Metropolitan Sanitary District of Greater Chicago (MSDGC), Illinois, evaluated the nitrification of SLS by rotating disk system (RDS). The SLS taken from the digested sludge holding basins at the District's land reclamation site in Fulton County was tested in a rotating disk pilot unit consisting of a 35 gal semicircular tank which was divided into four equal compartments and contained polyethylene disks providing 250 sq ft of total surface area. During the 47 weeks of the experiment, successful nitrification of a high-strength ammonia waste water was achieved under both ambient summer and winter of 15.5 lb NH3-N/day/1000 cu ft and a waste water temperature of 10 C, 99.4% of the ammonia was removed. Increasing the loading to 43.5 lb and the temperature to 20 C, increased the ammonia removal to 99.8%. Significantly higher removal rates would be possible if uniform growth could be established over all of the disks of the four stages. Nitrifying growth must be established on the disks before the beginning of winter. The effects of clarifying the effluent and recycling the flow during winter operation in an attempt to improve nitrification efficiency were minimal. (Orr-FIRL)

WASTEWATER TREATMENT EVALUATION, MATHER AIR FORCE BASE, CALIFORNIA, Environmental Health Lab., McClellan AFB, Calif.

C. F. Pauls.

Available from the National Technical Information Service, Springfield, Va 22161 as AD-A 010-872, \$5.50 in paper copy, \$2.25 in microfiche. June, 1974, 91 p, 5 fig, 21 tab, 13 ref. Descriptors: *Waste water treatment, *Treatment facilities, *Surveys, Effluents, Biochemical oxygen demand, Water quality control, Maintenance, Equipment, California.

Identifiers: National Pollutant Discharge Elimina-

tion System(NPDES).

In order to apply for a discharge permit from the EPA under the terms of the National Pollutant Discharge Elimination System, a survey was conducted of the waste water treatment facilities at Mather Air Force Base in California. The survey required samples to be taken from the effluent lines of the oil separators serving the aircraft and AGE washracks, from each of the plant units, and from the effluent sewer serving the metal cleaning and plating operation. The samples were analyzed for factors including alkalinity, BOD, COD, presence of solids, oil and grease, phenols, pesticides, and phosphates. Complete lists of analyses, methods, and results are given in tables. The discharge from the treatment plant, the polishing pond, and the drainage ditch met national standards. The first stage of the treatment facility did not provide sufficient reduction on BOD, SS, or fecal coliform organisms to provide secondary treatment according to EPA standards. Discharge from an inoperative lift station and overflow lines and underdrains from the oil separators were both sources of uncontrolled water pollution and required modification. Suggestions were made for improvement of the treatment facilities, of the drainage systems, and of equipment operation. It was also recommended that maintenance be improved and a maintenance program be developed. (Loustau-FIRL) W76-05801

WASTEWATER TREATMENT EVALUATION, MT. HEBO AIR FORCE STATION, OREGON, Environmental Health Lab., McClellan AFB, Calif.

C. F. Pauls. Available from the National Technical Information Service, Springfield, Va 22161 as AD-A 009 471, \$5.00 in paper copy, \$2.25 in microfiche. February, 1975. 72 p, 6 fig, 12 tab, 8 ref.

Descriptors: *Waste water treatment, *Treatment facilities, *Biological treatment, *Trickling filters, Municipal wastes, Water quality control, Oregon, Evaluation.

Samples from Mt. Hebo's site and housing area domestic waste water treatment facility analyzed and compared with the standards of the National Pollutant Discharge Elimination System issued by the EPA. Each treatment facility's performance was compared with predicted per-formance standards based on design equations or with standard practice. Results of chemical and bacteriological analyses are given in tables and discussed in detail in the article. The effluent from the site and housing treatment facilities did not meet the national standards, so recommendations were made for improving existing facilities. These recommendations include repairing the secondary clarifier at the site treatment facility that was ineffective at the time of testing, modifying the conveyance system at the housing area facility, and improving the trickling filter. It was also suggested that better maintenance and operational control could improve plant efficiency at both locations. Automated equipment for monitoring effluent is being considered for the facilities. Secondary effluents from the facilities can be applied to the soil and infiltrated into the ground as no undesirable affects can be foreseen. (Loustau-FIRL) W76-05802

AN EVALUATION OF THE USE OF GAMMA RADIATION IN SEWAGE TREATMENT, Australian Atomic Energy Commission Research

Australian Atomic Energy Commission Research Establishment, Lucas Heights. P. A. Bonhote, J. G. Clouston, G. W. K. Ford, and N. J. Gregory.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Waste Treatment Processes—Group 5D

Available from the National Technical Informa-Available Holm the National Technical Information Service, Springfield, Va 22161 as AAEC-E 330, \$4.00 in paper copy, \$2.25 in microfiche. December, 1974. 2 fig, 2 tab, 6 append.

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Descriptors: *Sewage treatment, *Gamma rays, *Costs, *Waste water treatment, Coliforms, Biodegradation, Australia.

A critical assessment of sewage treatment with gamma radiation was made by the Australian Atomic Energy Commission Research Establishment. The assessment was undertaken in response ment. The assessment was undertaken in response to a claim made by Energy Systems Incorporated of Florida that cobalt-60 irradiation was advantageous in recovering sewage water. The subject was considered for cost factor, the physical and chemical effects of radiation for purification and recovery, of waste water, and for radiation effects on the microbiology of waste water. To date there is little literature indicating entire statistications. there is little literature indicating significant contributions to sewage recovery methods by irradiation. Statements on the lethality of irradiation to viruses are not substantially validated. The coliform count is not an indicator of effective sewage treatment and can be misleading. The irradiation dose of 100,000 rad is not adequate and a significant dose increase would be necessary. Irsignificant dose increase would be necessary. Irradiation has no significant effect on the degradation of pesticides and detergents. In sum, irradiation methods have at present no cost advantage, no proven technical advantage and no proven biological advantage over known treatment systems and may have a psychological disadvantage owing to the still prevalent public suspicion of all things associated with ionizing radiation (Loughant Little). tion. (Loustau-FIRL) W76-05803

REMOVAL OF DETERGENT FLUORESCENT WHITENING AGENTS FROM WASTE WATER, CIBA-GEIGY Corp., Greensboro, N. C. Dyestuffs and Chemicals Div. C. R. Ganz, C. Liebert, J. Schulze, and P. S.

Stensby.

Journal Water Pollution Control Federation, Vol. 47, No. 12, p 2834-2849, December, 1975.

Descriptors: *Detergents, *Waste water treatment, Suspended solids, Trickling filters, Solid wastes, Toxicity, Soils, Waste disposal. Identifiers: *Fluorescent whitening agents(FWA).

Although studies have shown that fluorescent whitening agents (FWA) in detergents are innocuous, little is known as to their removal from water and ultimate disposal. In-depth analyses of representative waste water treatment plants' abili-ties to remove FWA's were made by analysis of solid and liquid influent and effluent. On the whole, the removal of FWA's in the primary process correlated with the removal of suspended solids. The trickling filter process eliminated much of the remaining FWA's so that average FWA removal was on the order of 95%. FWA content in the settled sludge was in the milligram per liter range. Because these results showed that much of the FWA's discharged into the treatment plants was removed as part of the solid waste component, it was deemed appropriate to determine whether FWA's in sludge landfill could be leached out by rainwater. Core samples from simulated landfill sludge exposed to natural conditions showed that a negligible quantity of FWA's was leached from the sludge over a 70-day exposure period. Since there is some interest in using sludge for a soil improvement agent, the ability of crops to accumulate FWA's from treated soil was stu-died. It was suggested that FWA's will not likely be taken up by major crops when present in planting soils. (Loustau-FIRL) W76-05804

PROGRESS IN METHODS OF NITRATE REMOVAL, Department

A. H. Goodman. Water Treatment and Examination, Vol. 24, No. 3, p 1570-1571, 1975, 12 ref.

Descriptors: *Nitrates, *Nutrient removal, *Water treatment, *Waste water treatment, Denitrification, Nitrogen, Methanol, Rivers, Potable water. Identifiers: *Nitrate removal.

Reduction of nitrate content in water can be ac-complished using two broad methods. One method, of which ion-exchange and reverse-osmosis are examples, involves concentrating nitrate into a reject fraction. The other method utilizes biological denitrification. Various studies are being conducted on the conditions necessary for denitrification in biological systems. It was known that denitrification occurred in soils and it was observed that in studies of river water nitrate was served that in studies of river water nitrate was reduced even though a high level of BOD was present. It appeared that those responsible for denitrification were heterotrophic organisms which utilized not only organic carbon but also nitrogen. It then became apparent that rivers with much oxidized sewage effluent must contain high proportions of nitrate. Therefore, a denitrification step would have to be incorporated into the sewage treatment plant if the rivers were to be a supply of potable water. One system studied was supply of potable water. One system studied was the addition of methanol to sewage effluent, followed by treatment in a flooded biological filter. lowed by treatment in a flooded biological filter. Then, to overcome the accumulation of solid matter in the filter, experiments were made with upward-flow units containing sand. An unaccountable loss of nitrogen in the aeration plant led to the use of a small amount of air to keep the solids suspended in the water. Eventually it was found that with little additional cost, 50% nitrate removal was possible in existing treatment plants. Work in denitrification continued with an examination of the mechanism whereby ammonia in vier water could be oxidized during upward flow river water could be oxidized during upward flow settlement. This led to a fluidized sand bed process with methanol introduced to stimulate denitrification. Because the use of toxic methanol in water being made potable would cause concern, the substitution of reducing sugars for methanol is now under consideration. (Loustau-FIRL) W76-05805

NITRATE REMOVAL FROM WATER BY ION EXCHANGE,

Water Research Centre, Medmenham (England). Medmenham Lab. For primary bibliographic entry see Field 5F. W76-05806

ENGINEERS CAN EXERT PROCESS CONTROL OVER DIGESTER INPUTS,

Envirex, Inc., Milwaukee, Wis.

N. A. Mignone.

Water and Sewage Works, Vol. 122, No. 11, p 51-53, November, 1975. 3 fig, 1 tab, 2 ref. Descriptors: *Anaerobic digestion, *Activated sludge, Hydraulics, Equipment, Kinetics, *Waste

water treatment, Costs. Identifiers: Thickening, Waste activated sludge, *Flotation thickeners.

Anaerobic digestion can be controlled better by using a dissolved air flotation thickener instead of a gravity thickener. Many of the problems as-sociated with anaerobic digestion of combined pri-mary and waste activated sludge can be attributed directly to hydraulic overload which causes reduction in digester operating temperature, washout of organisms and dilution of system buffering capacity. If a dissolved air flotation thickener is placed immediately before the anaerobic digestion system, hydraulic overload can be prevented and the operation of the system will be vastly im-proved. Another feature of the dissolved air flotation unit is its function as a secondary grit removal facility. It can also produce a thicker combined sludge, thus allowing for smaller downstream equipment, meaning less capital and maintenance cost compared to past systems. Development work is being undertaken to automate the dis-solved air floation unit process in order to main-tain the desired solids concentration under the various expected inflow conditions. (Loustau-W76-05807

SLUDGE DEWATERING TRIALS AT RANKU.

J. M. Sidwick, B. E. Butler, and N. J. Ruscombe-

King. Water Pollution Control, Vol. 74, No. 6, p 675-687, 1975. 4 fig, 3 tab, 3 ref.

Descriptors: *Sludge treatment, *Dewatering, *Centrifugation, Equipment, Polyelectrolytes, Operation, Design criteria, Suspended solids, *Waste water treatment. Identifiers: Centrifuge machines.

Five centrifuge machines were tested and com-pared for efficiency in dewatering crude sludge. Of the machines tested, four were long-bowl de-canters and one was an internal-bowl machine. During the trial week 23 runs were completed by the machines. The operators were asked to produce a sludge cake containing 22 to 23% dry solids with a centrate containing 750 to 1000 mg/liter. No other constraints were imposed. The same feed sludge was fed to all machines. The results show that all the centrifuges had difficulty results show that all the centrituges and utilitative in achieving centrate suspended solids concentrations below 1000 mg/liter, but both methods were suitable for dewatering sludge. The long-bowl machines were more successful in producing a cake of the required quality than the internal-bowl machine. After the trial week, one machine was kept for further testing to see whether its results could be improved with different throughput rates and different polyelectrolyte dosages. Recovery improved for that machine as throughput was reduced. For any one throughput, there is an optimum polyelectrolyte dose. At higher throughputs, recovery is more sensitive to changes in polyelectrolyte dose. More detailed analysis of operating variables was not possible during the short time of this trial. (Loustau-FIRL) W76-05809

INDUSTRIAL COST RECOVERY AND USER CHARGE ASSESSMENTS, Bovay Engineers, Inc., Spokane, Wash.

For primary bibliographic entry see Field 5G.

AN ECONOMIC MODEL OF WATER USE AND WASTE TREATMENT,

Houston Univ., Tex. F. D. Singleton, J. A. Calloway, and R. G. Thompson.

Thompson.

Presented at the Second National Conference on Water Reuse: Water's Interface with Energy, Air and Solids, May 4-8, 1975, Palmer House, Chicago, Ill. 27 p., 4 fig., 9 tab., 18 ref. NSF (RANN) GI-34459-2.

Descriptors: *Linear programming, *Industries, *Water utilization, *Waste water treatment, *Estimated costs, Industrial water, Recycling, Mathematical models, Systems analysis, conservation.

A model that determines the costs of water use and the best practicable control technology cur-rently available, the best technology economically achievable, and zero waste discharges in existing heavy water-using industries provides total cost estimates and the incremental savings in waste treatment costs gained from redesigning produc-tion facilities and reducing each major pollutant. The potential savings in waste treatment costs may be compared with the increased costs of new production facilities to determine the feasibility of

Group 5D-Waste Treatment Processes

making such an investment. The model can be applied to water use and waste treatment costs for chemicals, petroleum refining, pulp and paper, primary metals, and electric power generation industries. Specific features of the model include (1) use of underlying nonlinear models to determine technical coefficients in the comprehensive linear model, (2) separate accounting for each waste stream component (COD, BOD, oil, ammonia, phenol, sulfides, TDS, and water volume), and (3) the use of both fixed and variable cost components. Use of the model is simple and inexpensive in analyzing a single stream or in interfacing with a linear process model. Use of separate component accounting and nonlinear support models eliminates many of the problems of linear estimation of nonlinear functions. (Auen-Wisconsin)

PORT COLLECTION AND SEPARATION FACILITIES FOR OILY WASTES, VOL. 5, A COMPARATIVE ANALYSIS OF CONCEPTUAL SYSTEM PLANS FOR THE SURVEYED PORTS UNDER THE 'NO DISCHARGE', '1969 AMEND-MENTS' AND 'NO SHEEN' CRITERIA,

Harris (Frederick R.), Inc., New York. R. L. Forster, J. E. Moyer, and C. G. Papacosta. Available from the National Technical Information Service, Springfield, Va 22161, as COM74 10012 \$12.00 in paper copy, \$2.25 in microfiche. Report MA-RD-900-74010, August 1973. 463 p. 20 fig., 157 tab., 58 ref.

Descriptors: *Pollution abatement, *Harbors, *Oil wastes, Ships, Estimating, *Treatment facilities, Waste disposal, Governments, Economic impact, Recycling, Regulation, Costs, Equipment, *Separation techniques, *Waste water treatment, Return(Monetary), Industries, Water quality stan-

Identifiers: *Collection facilities(Ships), On-board treatment, No discharge requirement, Zero discharge.

The types of oil wastes brought into ports as exemplified by New York, Hampton Roads, San Francisco, St. Louis, San Diego, Houston, Texas City, Galveston, Miami, Cleveland, and San Juan by non-military shipping were identified and estimates made of quantities, based on total prohibition of overboard dumping, the 1969 Amendments to the 1954 IMCO Convention, and the no sheen criteria, anticipated for 1975 and 1980. Systems for collecting, treating, and disposing of oil wastes with no additional environmental degradation were evaluated to determine if they could be used with the new waste loads, or if they could be modified to suit the new loads, or if new systems had to be developed. Cost estimates were also made for the selected ports. The entrepreneureal potential for private industry to operate the potential for private industry to operate the revised oily waste handling systems is discussed. The government's role with respect to the different operations, the ship operator, and the builder is described. The impact on shipping costs is evaluated. A shoreside oil/water separator process facility which could be used in small ports having an oily water waste load of 1.4 million gal-lons per year or less is described. (Buchanan-Davidson-Wisconsin). W76-05830

DESIGN AND OPERATION OF HIGH-RATE FILTERS--PART 2,

Montgomery (James M.), Inc., Pasadena, Calif. Water Treatment Div.

S. Kawamura.

American Water Works Association Journal, Vol.67, No. 11, p 653-662, November, 1975. 10 fig,

Descriptors: *Filters, *Design criteria, *Waste water treatment, *Water treatment, *Filtration, Flow control, Flow rates. Identifiers: *High-rate filters, Backwash, Filter

The design of high-rate filters is mostly related to the physical factors of the filter-washing process, the process by which water flows upward through filter media particles. The major factors of the filter-washing process are size and specific gravity of filter media; type and arrangement of filter un derdrain system; number, size, and location of wash-water troughs; size and elevation of the wash-water tank, or capacity and head of the wash-water pumps; backwash rate-control wash-water wash-water pumps; backwash rate-control system; and type and capacity of auxiliary scour. Of the three basic types of filter-washing processes, the fluidized filter bed is used in the United States, the air-scour wash is practiced in Europe, and the third is a combination of the other two. The article discusses various aspects of filter washing, including appropriate backwash rates. (See also W76-05832) (Loustau-FIRL)

DESIGN AND OPERATION OF HIGH-RATE FILTERS--PART 3,

Montgomery (James M.), Inc., Pasadena, Calif. Water Treatment Div. For primary bibliographic entry see Field 5F. W76-05832

RESTORING THE QUALITY OF URBAN RECEIVING WATERS: INTERFACING UP-GRADED TREATMENT FACILITIES WITH THE STREAM,

Clemson Univ., S. C. Dept. of Environmental Systems Engineering.

B. C. Dysart, III, and T. M. Keinath.

Available from the National Technical Informa-Available from the National Technical Informa-tion Service, Springfield, Va 22161 as pB-251 376, \$7.50 in paper copy, \$2.25 in microfiche. South Carolina, Water Resources Research Institute, Clemson, Report No. 46, June 1974. 172 p, 74 fig, 7 tab, 5 append. S-035-SC

Descriptors: *Water quality control, *Tertiary treatment, *Waste water treatment, Municipal wastes, Operating costs, Water quality standards, Cities, Management, Pollution abatement.
Identifiers: *Urban water resources, *Waste treatment/stream interfacing.

The research demonstrated the feasibility of employing advanced waste treatment techniques added as adjuncts to overloaded existing conventional waste treatment facilities for protecting urban water resources from further degradation This is an attractive alternative to construction of additional capital intensive conventional waste treatment units which requires the sale of large bond issues. In contrast, the initial cost of advanced waste treatment units is relatively low even though their associated operating costs are relatively high. Because such units can be placed on- and off-line instantly, however, they will be utilized only when necessary to meet the water quality standards during adverse conditions in the receiving water such as might be encountered during hot, summer, low flow periods. Consequently, the annual cost for such processes, when used as an intermittent adjunct to conventional wastewater treatment facilities, will be considerably less than the comparable cost for expanding facilities in the traditional fashion and operating them con-tinuously. The research delineated the specific advanced waste treatment processes that are most effective, efficient, and adaptable for incorporating them into existing wastewater treatment facilities. The principal contribution was the develop-ment of realistic guidelines for adding advanced treatment processes to existing conventional facilities to provide more effective, economical, and reliable management of urban receiving waters W76-05839

AN ASSESSMENT OF AUTOMATIC SEWER FLOW SAMPLERS - 1975, EG and G Washington Analytical Services Center, Inc., Rockville, Md.

P. E. Shelley, and G. A. Kirkpatrick. Environmental Protection Agency, Report EPA-600/2-75-065, Dec 1975. 335 p, 29 fig, 6 tab, 32 ref. EPA 1BB034; ROAP 21 ASY; Task 039. 68-03-

Descriptors: *Sampling, *Sewage, *Sewers, Water analysis, Water quality, Water pollution, Effluents, *Storm sewers, Combined sewers, Overflow, Manholes, Outfall sewers, Sanitary en-gineering, Reviews, Cities, *Evaluation. Identifiers: *Automatic sewer flow samplers.

A brief review of the characteristics of storm and combined sewer flows is given followed by a general discussion of the purposes for and requirements of a sampling program. The desirable characteristics of automatic sampling equipment are set forth and problem areas are outlined. A compendium of 82 model classes covering over 200 models of commercially available and custom designed automatic samplers is given with descriptions and characterizations of each unit presented along with an evaluation of its suitability for a storm and/or combined sewer application. A review of field experience with automatic sampling equipment is given covering problems encountered and lessons learned. A technical assessment of the state-of-the-art in automatic sampler technology is presented, and design guides for development of a new, improved automatic sampler for use in storm and combined sewers are given. (See also W73-14221) (EPA) W76-05864

SEWER FLOW MEASUREMENT - A STATE-OF-THE-ART ASSESSMENT,

EG and G Washington Analytical Services Center, Inc., Rockville, Md. P. E. Shelley, and G. A. Kirkpatrick.

Environmental Protection Agency, Report EPA-600/2-75-027, November 1975. 423 p, 37 fig, 41 tab, 186 ref, 8 append. EPA 1BB034;ROAP 21ASY;Task 034. 68-03-0426.

Descriptors: *Flow measurement, *Flowmeters, Liquid flow, Open channel flow, *Pipe flow, Stream flow, Storm sewers, *Combined sewers, Overflows, Manholes, Outfall sewers, Sanitary engineering, Urban areas, *Water pollution control, Water quality, *Reviews.
Identifiers: *Equipment evaluation.

A brief review of the characteristics of storm and combined sewer flows is given, followed by a general discussion of the need for such flow measurement, the types of flow data required, and the time element in flow data. A discussion of desiraflow measuring equipment characteristics presents both equipment requirements as well as desirable features and includes an equipment evaluation sheet that can be used for a particular application. A compendium of over 70 different generic types of primary flow measurement devices, arranged according to the fundamental physical principles involved, is presented along with evaluations as to their suitability for measurement of storm or combined sewer flows. To illustrate the implementation of the physical principles, a number of commercially-available devices for flow measurement are briefly described. A review of project experience in flow measurement is presented along with a summary of current and on-going research efforts. Some thoughts on future areas of research and development are also given. (EPA) W76-05865

IMPACTS OF HYDROLOGIC MODIFICATION ON WATER QUALITY, MITRE Corp., McLean, Va. For primary bibliographic entry see Field 5G.

INTERIM REPORT ON THE IMPACT OF PUBLIC LAW 92-500 ON MUNICIPAL POLLUTION CONTROL TECHNOLOGY, Municipal Environmental Research Lab., Cincin-

nati Ohio

B. W. Lykins, Jr., and J. W. Smith. Available from the National Technical Informa-tion Service, Springfield, Va 22161, as PB-248 212, \$9.75 in paper copy, \$2.25 in microfiche. Report EPA-600/2-76-018, January 1976. 303 p, 48 fig, 35 tab, 31 ref, append. EPA 1BB033.

Descriptors: Water pollution, Sewage treatment, Waste treatment, *Reviews, Water quality, *Waste water treatment, *Treatment facilities, *Technology, Water quality standards, Surveys, Research priorities, Regulation, *Municipal

Identifiers: Water quality limited stream seg-ments. *Public Law 92-500.

This report presents available information that is used to examine the impact of water quality required by Public Law 92-500 on the effluent quality discharged from publicly owned wastewater treatment plants and assesses the adequacy of existing technology to meet these requirements Effluent standards that are more stringent than the national minimum requirement for 'secondary' treatment are identified. A major effort was devoted to reviewing state water quality stan-dards, identifying all water quality limited stream segments within each state, and summarizing and evaluating concentrations of pollutants in mu-nicipal wastewater treatment plant effluents reported in the 1973 Needs Survey. A comparison of existing technology with projected needs indicates that some form of technology is available to achieve the required removal of suspended solids, nitrogen and phosphorus. However, development and demonstration of additional technology are needed to reduce BOD concentrations to the required limits and to provide alternate disinfec-tion processes. (EPA) W76-05867

LIME USE IN WASTEWATER TREATMENT:

DESIGN AND COST DATA, Brown and Caldwell, Walnut Creek, Calif. D. S. Parker, E. de la Fuente, L. O. Britt, M. L.

Spealman, and R. J. Stenquist.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-248 181, \$9.75 in paper copy, \$2.25 in microfiche. Environmental Protection Agency, Report EPA-600/2-75-038, October 1975. 298 p. 63 fig, 67 tab, 7 ref, 2 ap-pend. EPA 1BB043; ROAP 21-ASD; Task 18 68-03-0334.

Descriptors: Sludge disposal, *Dewatering, Design, *Waste water treatment, *Lime, *Operating costs, Chemical precipitation, Sludge treatment, Ulmate disposal, Solid wastes, Cen-

Identifiers: *Chemical sludge processing, Centrifugal classification, *Centrifugal dewatering, Recalcination, Chemical treatment.

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Design and cost information on lime use in wastewater treatment applications is presented. Include is design and cost information on lime handling, liquid processing, solids generation and dewatering, lime recovery and ultimate ash disposal. A design manual approach is used so that the infor-mation presented has maximum usefulness to environmental engineers engaged in both the concep tual and detailed design of wastewater treatment plants. Design data on alternate sludge thickening and dewatering processes are presented with spe-cial emphasis on wet classification of calcium car-bonate from unwanted materials and on maximizing the dewatering of wasted soilids. Alternative recalcining techniques are assessed and problem areas identified. A relatively new technique for beneficiation of the recalcined product in presented. Approaches to heat recovery are presented that minimize the net energy requirements for recalcination and incineration. A computer program for computation of solids balances is included as a design aid and two case histories are presented which portray the cost of lime treatment, sludge processing and lime reclamation. (EPA) W76-05868

EFFECT OF MUNICIPAL TREATMENT PROCESSES ON PU-239, PU-240, AND CS-137, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div For primary bibliographic entry see Field 5F.

PROCESS AND EQUIPMENT FOR AUTO-MATIC CHEMICAL-BIOLOGICAL WASTE-WATER TREATMENT WITH PROVISIONS

FOR RECYCLE AND REUSE, Environment One Corp., Schenectady, N. Y. (Assignee).

R. P. Farrell, Jr., and J. L. Setser. U.S. Patent No. 3,920,550, 8 p, 3 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 940, No 3, p 1370, November 18, 1975.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, *Sewage treatment, *Water pollution treatment, Aerobic treatment, Settling basins, Waste disposal, Soil disposal fields, Water reuse, Impaired water use. Recirculated water.

A waste disposal system is provided that will retain a minimum amount of sludge, discharge a high quality effluent consistently which can be reused in various ways or recycled for flushing purposes. The waste first flows through a grinding mechanism and is then deposited in a holding tank where it accumulates to a predetermined quantity, at which time a pump unit is actuated to transfer the waste to a treatment tank. In the aerobic treatment and settling tank air is pumped through the waste material to enhance the aerobic action of the waste material to enhance the aeroote action of the microorganisms present for decomposing the waste material. Alternatively, or in addition, an agitator may be employed if necessary. When a predetermined quantity of waste material is present within the treatment and settling tank, the automatic controls are actuated to first feed and mix a flocculating chemical and then provide an absolutely quiescent period where additional raw waste will not be discharged from the holding tank, air will not enter the treatment and settling tank and the agitator, if present will be inoperative. After this settling period, most of the clarified supernatant will be pumped out into an effluent storage vessel. Sludge is removed to be further treated by microorganisms. The effluent storage tank receives the effluent from the treatment and settling tank, and may be used to supply a recycle demand system and dose the drain field; or it may be pumped to an irrigation system, a ground water recharge system, a suitable receiving stream, etc. (Sinha - OEIS) W76-05955

EVAPORATOR-CONDENSER UNIT PRODUCING POTABLE WATER UNIT FOR SEWAGE.

F. W. Taylor.

U.S. Patent No. 3,930,960, 6p, 6 fig, 12 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 415, January 6, 1976.

Descriptors: *Patents, *Liquid wastes, *Sewage effluents, *Waste water treatment, Water pollution treatment, Water quality control, Potable water, Heat transfer, Evaporation, Condensation, Separation techniques, Condensers, Evaporators.

An evaporator-condenser unit includes an elongated enclosed chamber into which hot gases are njected to form a cyclonic stream. The hot gases impinge and pass around a substantial number of tubes containing relatively cool sanitary liquid waste. Condensation forms on the tubes and is blown by the cyclonic action of the hot gas stream to the outer periphery of the chamber where the condensation is collected and conveyed away from the chamber. At the same time, the heat from the hot gases is transferred to the liquid sanitary waste which is converted into steam in a steam expansion chest at the top of the cyclonic chamber. The steam is compressed and injected back into the hot gas stream flowing into the cyclonic chamber. The steam is then condensed on the tubes and conveyed away for appropriate utiliza-tion. Clogging of the tubes by solid matter is prevented by means of a periodic blow down operation which forces the material in each of the tubes under high pressure into the steam expantubes under high pressure into the steam expansion chest. The steam expansion chest includes a sump which collects the liquid and solid waste. The cooled gases after passing through and about the tubes is conducted away from the cyclonic chamber to a discharge stack. (Sinha-OEIS)

WASTEWATER TREATMENT,

Sterling Drug, Inc., New York. (Assignee). P. V. Knopp, and W. B. Gitchel. U.S. Patent No. 3,930,998, 6 p, 1 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 427, January 6, 1976.

Descriptors: *Patents, *Waste water treatment. Sewage treatment, *Biological treatment, Water pollution treatment, Water pollution control, Nigrogen compounds, Denitrification, Ammonia, Biomass, Fertilizers.

A method is described for simultaneously removing organic carbonaceous material and nitrogenous material from sewage under improved conditions so as to accelerate the rate of removal of nitrogen. The rate of denitrification is accelerated by providing a suitable oxygen acceptor which may be substituted for acetate, methanol or other com-mercial organic biodegradeable material used as an oxygen acceptor. The invention also provides for removal and recovery of a portion of the nitrogen for a fertilizer. In the process wastewater containing reduced nitrogenous compounds is mixed with active nitrifying organisms and an oxygen-containing gas for a sufficient length of time to convert substantially all of the nitrogenous material to the nitrate form. The nitrifying organisms and accumulated biomass are recycled to remove a portion of the accumulated biomass from the nitrifying step. Nitrified wastewater is contacted with heterotrophic denitrifying organisms and an organic carbon source for a length of time sufficient to reduce the nitrate nitrogen to elemental nitrogen. Denitrifying organisms and accu-mulated biomass are separated from the denitrified wastewater and finally a final effluent with nitrogen removed is separated. The biomass removed from the nitrifying and denitrifying steps is heated in the presence of an oxygen-containing gas and converted to ammonia nitrogen. Ammonia is removed from the resulting liquid phase. (Sinha-OFIS) W76-05961

ION EXCHANGER FOR THE TREATMENT OF WASTE WATER.

S. E. Jorgensen.

U.S. Patent No. 3,931,003, 4 p, 3 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 428, January 6, 1976.

Descriptors: *Patents. *Waste water treatment, Water pollution treatment, Water pollution control, *Ion exchange, Separation techniques, Chemical reactions, Precipitation, Flocculation, Cellulose, Bark, Ammonia, Phosphates. Identifiers: Sulphonated bark.

Waste water containing dissolved high molecular organic compounds, ammonium ions and phosphate ions is pre-treated with a chemical

Group 5D-Waste Treatment Processes

selected from the group consisting of precipitating agents and floculating agents and then is passed through a bed consisting of a cellulose ion exchanger impregmated with betamanganese dioxide. The effluent is passed through a bed consist-ing of activated carbon impregnated with betamanganese dioxide. By passing pretreated waste water through the beds in the prescribed sequence, a particularly efficient treatment is achieved. A special advantage of the ion-exchanger material is that it can be eluated by means of sodium hydroxide so that all phosphate and ammonium nitrogen ions can be removed. (Sinha - OEIS) W76-05962

METHOD OF TREATING WASTE LIQUIDS FROM PHOTOGRAPHIC PROCESSINGS, Fuji Photo Film Co., Ltd., Kanagawa (Japan).

(Assignee).

I. Shimamura, and H. Iwano.

U.S. Patent No. 3,931,004, 7 p, 9 ref; Official Gazette of the United States Patent Office, Vol 942, No 1 p 429, January 6, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, Water pollution control, Water pollution treatment, *Ion exchange, *Resins, Chemical reactions, Separation techniques, Anion exchange.

Identifiers: *Photographic processing wastes, Cyanides, Farmer's reducer.

A method of treating waste liquids from photographic processings containing ferricyanide ions and/or ferrocyanide ions is described. A reducer is used for correcting or reducing the developed density of excessively exposed or excessively developed images or fringed or fogged images which are undesirable for making printing masters. The most commonly used reducers contain fer-ricyanide and thiosulfate. The reducers are dif-ferent from each other only in the concentration of ferricyanide and thiosulfate. Recently, such reducers have been called Farmer's reducers in the art. often comprising potassium ferricyanide and sodium thiosulfate. It has been discovered that if ammonium thiosulfate is added to the Farmer's reducer or sodium thiosulfate in the Farmer's reducer is replaced with ammonium thiosulfate, the ion-exchange power of the weakly basic anionexchange resin is increased and thus the recovery efficiency for ferricyanide ions and/or the ferrocyanide ions by the ion-exchange resin after regeneration is remarkable increased. (Sinha W76-05963

PROCESS FOR SEPARATING OIL FROM EMULSIONS OF OIL IN WATER,

U.S. Patent No. 3,931,005, 5 p, 5 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 429, January 6, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Industrial wastes, Water pol-lution treatment, Water pollution control, Water quality control, *Oily water, Emulsions, Flocula-tion, *Separation techniques, Chemical reactions, Iron compounds, Polymers, Hydrogen ion concentration

A single stage process which serves to separate oil from stable emulsions of oil in water, particularly from sewage which consists of or contains such stable emulsions of oil in water, is described. An iron salt, such as ferric sulfate or ferric chloride is added to the oil-containing sewage in a collecting container for these emulsions. The contents of the container are thoroughly mixed, e.g., with com-pressed air, and sodium hydroxide solution, preferably together with oil, such as mineral oil, is added to the resulting mixture in the reaction con-tainer itself or while the mixture flows to a reaction container and at such a rate that a pH value of 5.5-6.5 is obtained. Subsequently an aqueous solu-

tion of high molecular weight water soluble polymeric flocculating agent is added to the mix-ture. After mixing and then allowing it to stand for a sufficient period, it stratifies into two phases. When the separation for flotation has been effected, the oilfree clear water which has been separated and the oil-containing sludge are withdrawn in succession. The plant for carrying out the process comprises generally a reaction container and a unit which is comprised of a number of containers respectively intended to col-lect the emulsion, for the sludge, the old oil and the sodium hydroxide solution. (Sinha - OEIS)

METHOD OF REDUCING SLUDGE ACCUMU-LATION FROM TAR SANDS HOT WATER PROCESS

Great Canadian Oil Sands Ltd., Toronto (Ontario).

(Assignee). R. A. Baillie, and J. V. D. Fear.

U.S. Patent No. 3,931,006, 4 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 429, January 6, 1976.

Descriptors: *Patents, Effluents, *Water pollution control, *Mine water, *Settling basins, Sludge, Waste water, *Sludge treatment, Dispersion, Recirculated water, Reclaimed water, Water reuse, Compaction, *Waste water treatment. Identifiers: Tar sands.

The invention relates to a process for treating a retention pond containing the effluent discharge normally provided when bitumen is recovered from tar sands by way of hot water extraction techniques. Specifically, the process provides a means to improve the settling of the sludge portion of the retention pond in which effluent discharge is stored. The method essentially comprises discharging the effluent from the hot water extraction procedure in a manner so that it is widely dispersed over the surface of the retention pond. This method of adding effluent discharge to the pond allows the sand particles in the effluent to rain down on the pond and thereby rain down through the sludge layer at the bottom of the pond By this procedure, a part of the dispersed silt and clay in this sludge layer is included in the interstitial volume between sand grains so as to provide a pond containing a substantially smaller sludge layer volume. As a result of the method, more of the water in the pond is suitable for recycle to the hot water extraction technique thereby incorporating efficiencies of water usage in separation of bitumen from tar sands. (Sinha - OEIS) W76-05965

METHOD OF EXTRACTING HEAVY METALS FROM INDUSTRIAL WASTE WATERS, Nippon Electric Co. Ltd. Tokyo

(Japan). (Assignee). I. Sugano, T. Tsuji, and M. Kanamori.

U.S. Patent No. 3,931,007, 6 p, 3 fig, 3 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 429, January 6, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, Water pollution treatment, Water pollution control, Water quality control, *Heavy metals, Suspension, Oxidation, Chemical precipitation, *Separation techniqus. Identifiers: Ferrous ions.

A method of extracting heavy metals from acidcontaining waste water solution comprises adding to the solution ferrous ions and a base selected from the group consisting of hydroxides and car-bonates of alkali metals and alkaline earth metals and ammonium hydroxide. The amount of ferrous ions added is at least 2 times the amount in mols of the total mols of heavy metals present other than iron. The amount of base added corresponds to 0.9 to 1.2 equivalent of acid radicals present in the solution. This provides a suspension of metal hydroxides including ferrous hydroxide. An ox-

ygen containing gas is bubbled into the suspension to oxidize it and form a crystalline precipitate of essentially at least one of the ferric compounds selected from the group consisting of ferrites, magnetite and oxyhydrate of iron containing the heavy metals. The precipitate is separated to obtain clean water. (Sinha - OEIS) W76-05966 full

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APPARATUS FOR THE TREATMENT OF LIQUID WASTES, CIBA-GEIGY Ltd... Basel (Switzerland).

(Assignee).

(Assigner).
J. C. Page, A. Rappaz, and U. Frauchiger.
U.S. Patent No. 3,931,008, 5 p, 2 fig, 5 ref; Official
Gazette of the United States Patent Office, Vol 942, No 1, p 430, January 6, 1976.

Descriptors: *Waste water treatment, *Patents, *Industrial wastes, *Chemical wastes, Water pollution treatment, Water pollution control, Water quality control, Separation techniques, Chemical reactions, Chemical precipitation, Waste dilution, Equipment.

An apparatus is described which treats liquid wastes from commercial or industrial production and processing plants. The wastes because of their chemical nature or content of chemical substances are chemically not compatible with one another and may react to each other to form precipitates, foam, gases, or other toxic substances. Therefore the wastes must have pretreatment to convert them so they can be combined and diluted before being discharged into general effluent streams, sewage installations, settling basins, etc. An apparatus for the treatment of at least two liquid wastes is comprised of an addition zone for the addition of treatment substances, a sedimentation zone for the separation of precipitates and liquid, and a dilution zone in which the separated liquid is diluted. The use of pumps is restricted as far as possible and transport of quantities of liquid of substantial volume takes place under the action of gravity. At the same time products which separate out and from which valuable chemical substances can be recovered are isolated. (Sinha - OEIS) W76-05967

WATER PURIFICATION APPARATUS AND TIMING DEVICE FOR INITIATING A BACKWASHING CYCLE,

For primary bibliographic entry see Field 5F. W76-05968

SEWAGE TREATMENT SYSTEM,

Atlantic Fluidics, Inc., Stamford, (Assignee).

U.S. Patent No. 3,931,012, 7 p, 9 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 431, January 6, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Water pollution control, Water purification, Filtration, Incineration, Sludge disposal, Oxygenation, Ozone, Ultimate disposal

A system incorporating a highly effective, self cleaning, mechanical filtering means to separate solids from water as soon as possible after the pollutants have been flushed into the system described. This device is located at the site where the pollution originates and therefore its effectiveness is enhanced by reducing the time of contact between water and organic contaminants. A maintenance-free fully automatic incinerator is provided to reduce the solids totally to inert ash after separation of solids from water. This is accom-plished in an electically operated incinerator utilizing high intensity radiant heat to evaporate and degasify the solids in the absence of oxygen, and means of an electrically operated afterburner to

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Waste Treatment Processes—Group 5D

fully consume the organic emission. The total incineration is accomplished without air pollution in the form of smoke, odors, or vapor plume. A storage or retention tank is provided for the filtered effluent and means to pump it to a series of reactor columns in which the effluent is purified by means of contact with ozone. The ozone, produced from air or pure oxygen, is injected into the bottom of the column and it rises by gravity to the top. The water, is introduced at the top of the column and it flows downward in a counter-current direction in relation to the ozone. The sewage treatment system can be split into separate components with the separator-filter and incinerator located at the site of sewage generation and the effluent treatment system and ozonator located at a remote site. (Sinha - OEIS) W76-05969

METHOD OF PREVENTING SCALE FROM BEING DEPOSITED IN CASE OF PRODUCING FRESH WATER FROM SEA WATER, Industrial Science and Technology, Tokyo

(Japan). (Assignee). For primary bibliographic entry see Field 3A.

METHOD FOR THE PRIMARY AND SECONDARY TREATMENT OF WASTEWATER IN A UNITARY APPARATUS,

Autotrol Corp., Milwaukee, Wis. (Assignee). Autorio Corp., Miwaukee, Wis. (Assignee).
W. N. Torpey, and R. A. Sullivan.
U.S. Patent No. 3,932,273, 5 p, 5 fig, 5 ref; Official
Gazette of the United States Patent Office, Vol
942, No 2, p 884, January 13, 1976.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, *Sewage, Water Pollution control, Water pollution treatment, *Biological treatment, Settling basins, Aerobic conditions, Oxidation, Seperation techniques, Equipment.

A method utilizing a composite apparatus for the treatment of wastewater to remove settleable, floatable solids and to remove and oxidize organic matter includes a treatment tank having at least two horizontally adjacent bay. Each of the bays has an upper biological treatment zone seperated by horizontal baffle from a lower settling zone. Raw wastewater enters the settling zone of one of the bays where settleable and floatable solids are removed, and then turns vertically to flow in a direction through the upper biological treatment zone of each bay. The wastewater flows through the primary and secondary upper zones where soluble pollutants are oxidized by the aerobic slimes that grow and maintained on rotating contractors. Then the wastewater flows through the secondary settling zones where residual solids, primarily mature slimes sloughed off from the contractor, are removed. The wastewater after passing through the secondary settling zones is withdrawn from the end of the tank opposite the end in which the waste water was initially introduced. (Sinha-OEIS) W76-05972

PROCESS FOR THE TREATMENT OF MINERAL SLIMES.

Amax Resource Recovery Systems, Inc., Dayton,

Amax Resource Recording Gystallaria (Assignee).

A. R. Mewes, R. W. Styron, and M. H. Smith.
U.S. Patent No. 3,932,275, 6 p, 3 fig. 1 tab, 5 ref;
Official Gazette of the United States Patent Office Maidal Mola 984,885 lanuary 13, 1976. fice, Vol 942, No 2, p 884-885, January 13, 1976.

Descriptors: *Patents, *Waste water treatment, Water purification, *Industrial waste, *Mine wastes, Water pollution sources, *Fly ash, Polyelectrolytes, Dewatering, Phosphates, *Waste disposal, Flocculation, Coagulation. Identifiers: *Mineral slimes, Phosphate mining in-

lf

In a number of mining industries such as copper, iron, potash, phosphate, etc., waste products from the processing present serious disposal problems. Slimes are an aqueous suspension of ultrafine soil solids which are associated with the ore and which are put into solution during the processing. Mineral slimes exhibit colloid-like property that is believed to be largely responsible for their poor dewatering characteristic. A feasible method for dewatering mineral slimes while at the same time disposing of fly ash involves the controlled addidisposing of the same involves the controlled adultion of fly ash and then a polyectrolyte to the mineral slime. By slowly mixing these ingredients into the slime, flocculation occur and coagulated settle out producing a clear water layer which may be drawn off by decanting or other means. The fly ash is added at the rate of approximately 0.2% by weight of the total slime solution to be treated. Fly ash as collected by the precipitators at coal burn ing power plants may be used in the process either in dry or aqueous slurry form. Preferably the dry fly ash is slurried (with any sufficient amount of water) or otherwise conditioned so that it may be easily and thoroughly mixed with the slime then the polyelectrolyte is added. The polyelectrolyte may be any of the well known polymer materials such as polyacrylamide, polyethylene oxide, polyethyleneamine, polyvinyl aromatic sul-fonates; but is preferably a low anionic polyacrylamide. (Sinha-OEIS) W76-05973

FILTER CLEANING METHOD

Sterling Drug, Inc., New York. (Assignee). For primary bibliographic entry see Field 5F. W76-05974

MULTI-TANK ION EXCHANGE WATER TREATMENT SYSTEM,

Rock Valley Water Conditioning, Inc., Rockford, Ill. (Assignee). For primary bibliographic entry see Field 5F. W76-05975

DISSOLVED AIR FLOATATION SYSTEM.

942, No 2, p 887, January 13, 1976.

Tenco Hydro/Aerosciences, Inc., Countryside, Ill. (Assignee) G. A. Ettelt U.S. Patent No. 3,932,282, 5 p, 5 fig, 7 ref; Official Gazette of the United States Patent Office, Vol

Descriptors: *Patents, *Waste water treatment, Water pollution control, Water quality control, Water purification, *Flotation, Coagulation, *Aeration, Flow, Low flow, Equipment, Bubbles.

A waste treatment system is capable of removing particulate from a liquid mixture using the dissolved air flotation principle. A dissolved air flota-tion system for very small flows includes a flota-tion column having a greater vertical height than width for vertical flotation. An inlet is provided to the flotation column for carrying the combined waste and released bubbles from air-charged water. The column includes a release well comprising an inverted, truncated cone having an open base to permit upward flotation of the combined waste and bubbles. The inlet is coupled to the release well to provide tangential flow and helical flow in the release well thereby slowing the flow and preventing breakage of the bubbles. A clarified water outlet is provided at the lower portion of the flotation column. The outlet comprises a pipe defining openings on its circumference for passage of the water. A debris trap is at the top of the pipe whereby passage of clarified water into the pipe can only be accomplished through the openings. The system includes a positive displace-ment pump for pumping recycled water and an air column for damping the recycled water flow. A solubilization column is provided for dissolving air bubbles in a circulation route. A flotation cell is provided with an expansion valve on the downstream side of the solubilization column and

on the upstream side of the flotation cell, for releasing the air from the water that has been aircharged. The air bubbles and coagulated waste are combined and released in the flotation cell to float the top where they are discharged. (Sinha-OFIS)

METHOD AND APPARATUS FOR THE ANAEROBIC DIGESTION OF DECOMPOSA-BLE ORGANIC MATERIALS,

Bio-Gas of Colorado, Inc., Denver. (Assignee). F. T. Varani.

U.S. Patent No. 3,933,628, 7 p, 6 fig, 14 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1343, January 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution control, *Anaerobic conditions, *Solar radiation,
Anaerobic digestion, Digestion tanks, Methane, Heat transfer, Temperature control, Decomposing organic matter

Identifiers: Synthetic fuel production.

The principles and techniques used in waste water treatment can, with certain changes, be made adaptable to a synthetic fuels facility where the emphasis becomes one of gas production rather than potable water. These changes amount to a modification of the feed composition so as to optimize gas production, selecting operating tem-peratures most favorable to the methane-producing (methanogenic) bacteria and controlling the latter through the use of a solar-heated heat sink covering the digestor. Anaerobic bacterial decomposition of organic waste materials can be accomplished by covering and sealing the digestor with a liquid-filled pond forming a heat sink, then roofing over the latter with a translucent dome, preferably inflatable, which transmits solar energy to the fluid in the sink, and then using the fluid thus warmed as the heat transfer medium for maintaining the digestor temperature within prescribed limits. The digestor preferably comprises a trench capable of retaining the feed-stock, the open top of which is both closed and sealed by means of a cover that functions as the receptable for the fluid in the pond. This cover can float on the feedstock in the point. This cover can float on the feedstock slurry in the digestor and the effluent from the digestor is ideally suited for use as the heat transfer medium in the pond because its dark brown to black color is highly absorptive of the solar energy. (Sinha - OEIS) W76-05981

PURIFICATION OF WASTE WATER CON-TAINING PHTHALIC ESTERS,

Rhone-Progil, Courbevoie (France). (Assignee). Helgorsky, and M. Auroy. U.S. Patent No. 3,933,630, 4 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1344, January 20, 1976.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, Water pollution control, Water quality control, *Chemical wastes, *Industrial wastes, Separation techniques, Chemical reactions, Organic compounds, Alcohols. Identifiers: *Phthalic esters.

One of the processes which is most widely used on an industrial scale for the production of dialkyl phthalates is esterification of the corresponding alcohol by phthalic anhydride or acid in the presence of sulfuric acid acting as a catalyst. In order to purify the dialkyl phthalate, the neutral or acid esters are subjected to a series of operations: careful hydrolysis of the esters, destruction of the neutral alkyl sulfate, neutralization of the acid functions by a base, washing operations, or decantation operations; this results in waste waters comprising all the water-soluble impurities from the process and particularly the salts of organic acid, and a small amount of the unreacted starting materials

Group 5D-Waste Treatment Processes

for the esterification operation. A process for the purification of waste water resulting from the production of phthalic esters by esterification of phthalic acid or anhydride with alcohols having more than 4 carbon atoms comprises acidifying the waste water with a strong acid to attain a free acidity of the waste water greater than 0.05 N and extracting the acidified water with an alcohol having more than 4 carbon atoms for removal or ornic impurities from the acidified water. (Sinha -OEIS) W76-05982

METHOD OF TREATMENT OF SLUDGES WITH SIZE-ADJUSTED CARBON.

U.S. Patent No. 3,933,634, 9 p, 4 fig, 1 tab, 7 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1345, January 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Sludge treatment, *Separation techniques, *Water pollution treatment, Coagulation, Coals, Lignite, Filtration, Water purification, Incineration, Sludge disposal.

A process for concentrating and separating solids from solid/liquid mixtures in the treatment of sewage sludge is described. The process comprises incorporating into such sludge 2 to 10% by weight of fine dust coal or lignite having such a size distribution that 30 to 50% by weight of the whole particles have a finer size not greater than 100 mesh and 70 to 50% by weight of the whole particles having a size exceeding 100 mesh, mixing them under agitation, incorporating into the mixture a coagulant of the iron-aluminum type in an amount of from one-fiftieth to one-tenth of the fine dust coal or lignite, allowing the sulting mix-ture to stand still for about 20 minutes to 2 hours to separate it into a coal-containing concentrated sludge and a supernatant liquor. The coal-contain-ing concentrated sludge is further subjected to filtration treatment to remove water. When the sludge is introduced on filtering material the coarser particles of the fine dust coal are first allowed to sediment on the filter cloth to form a precoat layer, then agglomerates of finer particles are sucked and deposited in the form of a compressed sludge layer. The water content of the resulting filter cake is low and the filter cake can readily be used as fuel for incineration of rubbish and refuse. (Sinha - OEIS)

METHOD FOR REMOVING SOLUBLE SELENI-UM FROM ACIDIC WASTE WATER,
Department of the Interior, Washington, D. C. Of-

fice of the Secretary. (Assignee).

W. N. Marchant. U.S. Patent No. 3,933,635, 3 p, 2 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1345, January 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Acidic water, Water pollution treatment, Water pollution control, Water quality Separation techniques, tion(Chemical), Zinc.

Identifiers: Selenium, Zinc smelter effluents, Scrubber water.

An effective, rapid and economical removal of selenium from acidic waste water solutions may be achieved by treatment of such solutions with a metallic reducing agent. The method is particularly applicable to removal of selenium from zinc smelter effluent by treatment of the effluent with metallic zone. It may also be employed for removal of selenium from other aqueous wastes such as those from copper refining processes, scrubber solutions from coal burning operations, etc. In addition, other metallic reducing agents such as iron or aluminum may be used. Optimum temperature and pH for precipitation of selenium will vary considerably depending upon the specific

waste water treated and the reducing agent employed. A temperature of about 25 deg to 85 deg C and a pH of about 1 to 4 is suitable. A time of about 1 to 10 minutes is sufficient for maximum precipitation of the selenium. Following completion of the reaction, precipitated solids, consisting predominantly of selenium and any unreacted reducing agent, may be separated from the remaining solution by any conventional means such as filtration, decanting, etc. (Sinha - OEIS) W76-05986

METHODS AND APPARATUS FOR TREATING WASTEWATER,

Airco, Inc., Montvale, N. J. (Assignee). B. S. Kirk, and R. M. Chappel.
U.S. Patent No. 3,933,640, 9 p, 6 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1347, January 20, 1976.

Descriptors: *Patents, Waste water treatment, *Sewage treatment, *Water pollution treatment, Water pollution control, Water quality control, *Oxygenation. Activated sludge, Microbial *Oxygenation, Activated sludge, digestion, Mixing, Equipment.

Methods and apparatus treating wastewater, such as municipal sewage, are provided in which an oxygen enriched feed gas is supplied to an oxygenation changed and oxygen is efficiently dissolved in wastewater (mixed liquor) by means of a static mixing device. The chamber is preferably sub-merged in a large body of wastewater being treated, such as is commonly found in the secondary stage of an activated sludge wastewater treatment system with the chamber being adapted receive such wastewater from a location slightly elow the surface. Oxygenated wastewater is discharged from the chamber in either radical or multi-directional pattern at a sufficient velocity to effect a thorough mixing of the oxygenated wastewater and the large body of wastewater contained in the secondary stage treatment tank. The overall concentration of dissolved oxygen in the wastewater is maintained throughout a tank to a level sufficient to sustain microbial digestion or organic waste while providing the requisite stirring necessary to preclude settling of solids from the wastewater. (Sinha - OEIS) W76-05987

SEWAGE TREATMENT AND RECYCLING SYSTEM,

Engineering Enterprises, Honeybrook, Pa. (Assignee). L. C. Hadden, and C. T. Benjamin.

U.S. Patent No. 3,933,641, 5 p, 5 fig, 12 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1348, January 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, Water pollution control, Water quality control, Septic tanks, Domestic wastes, Aerobic conditions, Filtration, Chlorination, *Water reuse, *Recycling, Irrigation, Water conservation

A sewage treatment system for residential or commercial application comprises a septic tank having suitable compartment for initially treating the sewage by aerobic bacterial action. The effluent flows from the septic tank onto perforated splash pan which is designed to distribute the effluent evenly over the surface of a first filter which is removable. The effluent flows through this first fi lter and then flows through a second filter in which the coliform and biological oxygen demand are reduced to acceptable levels. This filtered effluent then flows into a holding tank from which it is pumped to a pressure tank. Prior to entering the pressure tank the effluent is chlorinated and then discharged or pumped to the surface. The treated effluent can be used in irrigation or plumbing system of the facility to which the system is connected. (Sinha - OEIS) FLOCCULATION APPARATUS, For primary bibliographic entry see Field 5F. W76-05989

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Toray Industries, Inc., Tokyo (Japan). (Assignee). For primary bibliographic entry see Field 3A W76-05990

APPARATUS FOR THE SEPARATION OF LIQUID MIXTURES MY MEANS OF PERMEA-BILITY SELECTIVE SEPARATION MEM-BRANES

Louis Schleiffer A. G., Feldbach (Switzerland). (Assignee). For primary bibliographic entry see Field 3A.

CLEAN WATER GRANT PROGRAM. In: 1975 BNA Environmental Rep 721:0509 - 18 (Calif. Water Code). 10 p.

W76-05991

Descriptors: *California, Grants, *Treatment *Water pollution treatment. *Construction costs, Administration, Cost allocation, Water policy, Economics, Water costs, Capital costs, State governments, Government finance, Payment, Administrative costs, Administrative agencies, Project planning.

To implement the Clean Water Bond Law of 1970, California has herein provided for a Clean Water Grant Program to assist in the financing of treatment works necessary to prevent water pollution. The State Water Resources Control Board shall compile a project list including treatment works proposed and under construction and shall assign priorities to each project according to stipulated criteria. All such projects must be accompanied by a project report providing technical, environmental, and financial information. Submission of construction grant requests for the preparation of plans, drawings and operation manuals, and of construction grant requests for eligible project costs must satisfy the application procedures. Eligible project costs include those costs which are necessary and ordinary costs of construction of treatment works, and which comply with state and federal rules. The Division of Water Quality of the state board evaluates completed applications and certifies the proposed project to the Environmental Protection Agency. Upon certification, the applicant shall execute a grant contract providing for pro rata installments of grant payments. Any discretionary action by the state board or division is open to review upon timely petition by the applicant. (Welch-Florida) W76-06064

THERMAL THERMAL PROCESSING AND LAND DISPOSAL OF SOLID WASTE.
Environmental Protection Agency, Washington,

Federal Register Vol. 39, No. 158, p. 29327-29338, August 15, 1974. 12 p.

Descriptors: *Standards, *Administrative agencies, *Waste disposal, *Landfills, *Adoption of practices, Local governments, Classification, Structural design, Operations, Inter-agency cooperation, Planning, Legislation, Coordination, Federal government, Structures, Programs, Water

Identifiers: *Administrative guidelines, *Waste disposal(Land), Solid Waste Disposal Act.

In April of 1973 the Environmental Protection Agency published guidelines in response to agency and public comment on earlier guidelines concerning thermal processing and land disposal of solid wastes. This document reviews those comments before setting out the 1974 requirements and recommended procedures. The guidelines apply to

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Ultimate Disposal Of Wastes—Group 5E

thermal processing facilities processing more than fifty tons a day of municipal waste not including hazardous, agricultural and mining wastes. The guidelines provide that owners and operators of thermal processing facilities shall determine whether special wastes can be processed and by what methods. Examples of special wastes which should be excluded are set forth, as well as requirements and procedures for site selection, water quality, air quality, safety, and recordkeeping. Where there is a solid waste land disposal site, its operations must meet minimum requirements. As for federal agencies, the guidelines are mandatory whether the site is on federal property or not. Waste from a non-federal source disposed on federal land must also meet the requirements. (Jenkins-Florida) W76-06082

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ents and ly to DESIGNATION AND DETERMINATION OF REMOVABILITY OF HAZARDOUS SUBSTANCES FROM WATER.
Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-06084

ENVIRONMENTAL PROTECTION AGENCY-POULTRY PROCESSING PRODUCTS, PROPOSED PERFORMANCE AND PRETREAT-MENT STANDARDS.

Environmental Protection Agency, Washington, DC

For primary bibliographic entry see Field 5G. W76-06096

5E. Ultimate Disposal Of Wastes

OPTIMAL GROUNDWATER QUALITY MANAGEMENT: WELL INJECTION OF WASTE WATERS,

Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W76-05507

SUBSURFACE DISPOSAL OF LIQUID INDUS-

TRIAL WASTES,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate. For primary bibliographic entry see Field 5B. W76-05573

PROTECTING GROUNDWATER FROM LAND. FILL LEACHATE,

Lycoming County Planning Commission, Williamsport, Pa.

For primary bibliographic entry see Field 5G. W76-05599

EXPERIMENTS ON THE OPTIMIZATION OF SLUDGE DEWATERING AND ON THE USE OF BARK AND SLUDGE IN THE BRICK INDUS-TRY (VERSUCHE ZUR OPTIMIERUNG DER SCHLAMMENTWAESSERUNG UND ZUR VER-WERTUNG VON RINDE UND SCHLAMM IN DER ZIEGELINDUSTRIE), Papiertechnische Stiftung, Munich (West Ger-

For primary bibliographic entry see Field 5D. W76-05704

CONTROL OF COAGULANT RECOVERY FROM EFFLUENT SEDIMENT (KONTROL' REGENERATSII KOAGULYANTOV IZ OSAD-KA CTOCHNYKH VOD), Nauchno-Issledovatel'skii Institut Sanitarnoi

Nauchno-Issledovatel'skii Institut Sanitarnoi Tekhniki i Oborudovania Zdanii i Sooruzhenii,

M. I. Medvedev, M. I. Dontsova, V. P. Tkachuk, V. P. Semenov, and I. G. Alesina.

Bumazhnaya Promyshlennost, No. 9, p 15-16, Sept., 1975. 2 fig.

*Sediments, *Coagulation, *Effluents, *Aluminum, *Sludge treatment, Calci-

*Effluents, *Aluminum, *Sludge treatment, Calcium hydroxide, Hydrogen ion concentration, Water pollution sources, Volumetric analysis, Acids, Sludge.
Identifiers: *Coagulants, Chemical recovery, Aluminum sulfate, Sodium bicarbonate, Sodium hydroxide, Aluminum hydroxide, Aluminum compounds.

Data available on the control of aluminum recovery from effluent sediments (sludge) show that the recommended pH is in many cases lower than the PH of saturated solutions of aluminum sulfate or chloride. A study of laboratory sedi-ments (obtained by mixing aluminum sulfate with sodium bicarbonate, NaOH, and calcium hydroxsodium bicaroonate, NaOH, and calcium hydroxide) showed that the age of the sediment and the alkaline component affect the time-dependent changes of pH, i.e., the rate of dissolution. This means that the pH of the regeneration process depends on the properties of aluminum hydroxide, which is determined by the cationic composition of the effluent and the age of the sediment. Thus, i n each case the pH must be determined experimentally. The simplest method would be by titra-tion of the sediment with a dilute acid. However, in titrating old sediments containing a considerable amount of organic substances, frequently flat titration curves are obtained and the inflection point is difficult to detect. Use of a differential reproducible in tests with laboratory-prepared and mill sediments (from coagulation of effluents that have and have not been subjected to biological purification). A line drawn through the peak of the differential curve perpendicular to the abscissa and to the integral titration curve gives the amount of acid required and the optimum pH. (Stapinski-IPC) W76-05725

EXPERIENCES AND POSSIBILITIES WITH THE ANDRITZ-SEM DOUBLE WIRE PRESS FOR SLUDGE DEWATERING, PARTICULARLY IN THE PAPER, PULP AND BOARD INDUSTRY (ERFAHRUNGEN UND MOEGLICHKEITEN MIT DER ANDRITZ-SEM DOPPELSIEBPRESSE BEI DER SCHLAM-MENT-WAESSERUNG, INSBESONDERE IN DER PAPIER-, ZELLSTOFF-UND KARTO Maschinenfabrik Andritz A. G., Graz (Austria).

E. Tutschek, and A. Wohlfarter. Wochenblatt fuer Papierfabrikation, Vol. 103, no. 23/24, p 931-934, Dec. 15, 1975. 5 fig, 1 illus, 5 ref.

Descriptors: *Sludge treatment, *Dewatering, Equipment, Design, Operation and maintenance, Pulp and paper industry, Pulp wastes, Wastes, In-dustrial wastes, Water pollution sources, Sludge, Sewage, Foreign countries, Solid wastes, Water pollution control, Water quality control. Identifiers: *Andritz-Sem dewatering press, Aus-

The design and operating principles of the Andritz-Sem double-wire press, developed by Maschinen-fabrik Andritz (Graz, Austria), are explained. Examples of its use on mixed sludge from a fine paper mill, on mixed sludge from the two-stage biological clarification unit of a sulfite mill, and on the primary sludge from a board mill are discussed, and some other uses indicated. The influence of fiber and filler content on sludge dewatering is also indicated. (Ward-IPC) W76-05729

MUNICIPAL WASTEWATER ODOR STILL A PROBLEM--PART 1, Pennsylvania State Univ., University Park.

For primary bibliographic entry see Field 5D. W76-05773

POND AND IRRIGATION SYSTEMS OFFER ECONOMY AND FLEXIBILITY, William and Works, Grand Rapids, Mich. For primary bibliographic entry see Field 5D. W76-05774

WASTEWATER RENOVATION AND REUSE:AN URGENT ENVIRONMENTAL NEED, For primary bibliographic entry see Field 5D. W76-05777

DESIGN, OPERATION, AND MONITORING OF MUNICIPAL IRRIGATION SYSTEMS, Williams and Works, Grand Rapids, Mich. Windins and works, Orland Rapids, Med. S. K. Malhotra, and E. A. Myers. Journal Water Pollution Control Federation, Vol. 47, No. 11, p 2627-2639, November, 1975. 3 fig, 3

Descriptors: *Irrigation, *Waste water disposal, Operating costs, Tertiary treatment, Hydraulics, Michigan, Groundwater quality, *De *Operations, *Monitoring, Municipal wastes. Identifiers: Land disposal. *Design,

Land disposal systems for municipal waste water provide a system with simplicity and low operating and maintenance costs. The various land disposal systems under construction or currently in operation in Michigan are continuously dosed seepage, intermittently dosed scepage, flood irrigation, ridge and furrow irrigation, solid set spray irrigation, traveling sprinkler spray irrigation, and center pivot sprinkler spray irrigation. Generally, the need for secondary treatment and winter storage has led to the use of oxidation ponds. Ir-rigation rates are detailed for hydraulic loading, organic loading, nitrogen loading, and phosphorous loading. Of the three most commonly phosphorous loading. Of the three most commonly used irrigation systems — flooding, ridge and fur-row, and spraying — flooding is best for flat and expensive land, ridge and furrow for flat land with medium to heavy soils, and spraying for steeply sloping sites. Farmers prefer spray irrigation for proper and effective crop management. Perennial grasses are the most popular crops, but corn is being grown at some sites successfully. To date none of the irrigation systems in Michigan has been found to result in a significant degradation of the chemical or bacteriological quality of the groundwater in its surrounding areas. Ground-water quality data from some of the systems in operation are listed in tables. (Loustau-FIRL) W76-05783

INCINERATION'S ROLE IN ULTIMATE DISPOSAL OF PROCESS WASTES, Incinerator Co., Huntington (England).

Chemical Engineering, Deskbook issue, p 141-150, October 6, 1975. 5 fig, 4 tab, 16 ref.

Descriptors: *Incineration, *Waste disposal, *Recycling, Organic compounds, Oxidation, Equipment. Identifiers: Waste heat, Refractories.

With the possibility of reclaiming a product or recovering waste heat, incineration as a final disposal process becomes increasingly interesting. To destroy satisfactorily organic material, the fur-nace volume must be sized for the physical bulk of material as well as for its calorific value. The correct combustion-air requirements must be met and velocities must be selected to ensure thorough mixing through turbulence in the combustion zone. The high-temperature zones must have a gas path of sufficient length and volumetric capacity to complete the combustion of volatiles. Whether the process of oxidation is to be carried out in grate space or in gas space must be considered. The most flexible incinerator designs for a range of applications are the multichamber/multicell units and the rotaries. Fluid-bed incineration is not very

Group 5E-Ultimate Disposal Of Wastes

flexible and power consumption is high, but with waste-heat recovery the costs may be offset. The multiple-hearth incinerator has found many successful aplications in the metallurgical industry as well as being applied to municipal and industrial wastes, but it is not very flexible either. Flexibility is important because within two or three years from entry into service, wastes will change as the process is modified. As a result, refractory materials must have the flexibility of coping with temperature changes. Monolithics, or refractories taken into service in an unfired state, are replacing brick as the first choice for incinerator Among emission collectors, the venturi scrubber is the most popular, but a new two-phase jet system is being studied. (Loustau-FIRL)

EDINBURGH'S SEWAGE-TREATMENT AND DISPOSAL SCHEME, Edinburgh Corp., (Scotland).

For primary bibliographic entry see Field 5D. W76-05794

REMOVAL OF DETERGENT FLUORESCENT WHITENING AGENTS FROM WASTE WATER, CIBA-GEIGY Corp., Greensboro, N. C. CIBA-GEIGY Corp., Gre Dyestuffs and Chemicals Div. For primary bibliographic entry see Field 5D. W76-05804

SEWAGE TREATMENT SYSTEM,

Fluidics, Inc., Stamford, Conn. Atlantic For primary bibliographic entry see Field 5D. W76-05969

PROCESS FOR THE TREATMENT OF MINERAL SLIMES,

Amax Resource Recovery Systems, Inc., Dayton, Ohio. (Assignee). For primary bibliographic entry see Field 5D. W76-05973

METHOD OF TREATMENT OF SLUDGES WITH SIZE-ADJUSTED CARBON, For primary bibliographic entry see Field 5D. W76-05985

CORPS ISSUES INTERIM RULES
DISCHARGES OF DREDGED AND FOR DISCHARGES MATERIALS.

For primary bibliographic entry see Field 5G. W76-06061

DISCHARGE REPORTS REQUIREMENTS.

For primary bibliographic entry see Field 5G. W76-06065

MICHIGAN WASTEWATER REPORTING AND SURVEILLANCE FEES RULES.

Michigan Dept. of Natural Resources E. Lansing. Water Resources Commission.
For primary bibliographic entry see Field 5G. W76-06067

THERMAL PROCESSING DISPOSAL OF SOLID WASTE. AND LAND

Environmental Protection Agency, Washington, D.C For primary bibliographic entry see Field 5D.

W76-06082

NAVIGABLE WATERS PROCEDURES AND GUIDELINES FOR DISPOSAL OF DREDGED

For primary bibliographic entry see Field 5G. W76-06097

5F. Water Treatment and **Quality Alteration**

POLLUTION CONTROL SYSTEM FOR WATER

Facuzzi Bros., Inc., Little Rock, Ark. (Assignee). R. E. Horan, Jr., and F. M. Nash.
U. S. Patent No. 3,928,197, 4 p, 4 fig, 10 ref; Official Gazette of the United States Patent Office,

Vol 941, No 4, p 1782, December 23, 1975.

Descriptors: *Patents, Water quality control, *Water treatment, Water pollution control, *Water purification, *Chlorination, *Disinfection, Filtration, Water supply.

A method is described for supplying a safe and palatable water service from a water system. The system has a pump connected to a water source and a service line. A receptacle assembly is used as a chlorinator which is so designed and so coupled into the flow line of the system so as to auto-matically supply chlorine at a flow rate which varies with the demand of the service. The receptacle assembly has an outer container preferably of fiber glass having an opening at it upper end, into which a closure with a depending neck is threaded. A collapsible bag of non-porous plastic is securred to the neck. A flow passageway is provided in the container and an additional one is in the collapsible bag. Flow connections establish a pressure differential which is a function of the pressure drop in the flow line which varies with the service de-mands on the system. The collapsible bag contains chlorine solution. If the system is quiescent, the pressure equalizes. Upon a demand for service a pressure differential developes resulting in the partial collapse of the bag and a discharge of the contents of the bag into the system. Once the ratio of chlorine solution to water has been established by adjustment of the metering valve, as the flow of water increases, the pressure differential across the chlorinator will likewise increase thus tending to maintain a substantially constant ratio of chlorine to water. Provision is made for refilling the collapsible bag. (Sinha-OEIS) W76-05530

SYNERGISTIC COMPOSITIONS CONTAINING 2,2-DIBROMO-3-NITRILOPROPIONAMIDE AND 3,3,4,4-TETRACHLOROTETRAHYDRO-THIOPENE-1,1-DIOXIDE AND THEIR USE, Betz Labs., Inc., Trevose, Pa. (Assignee).

R. H. Brink, Jr., B. F. Shema, and P. Swered. U.S. Patent No. 3,928,198, 5 p, 2 tab, 2 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1783, December 23, 1975

Descriptors: *Patents, *Water treatment, *Water pollution control, *Slime, *Aquatic microorgan-isms, *Industrial water, Biocontrol, Fungicides, Bactericides, Damages, Cooling water, Pulp and paper industry.
Identifiers: Biocides, DBNP, Diamond Shamrock

The invention provides methods and compositions for controlling slime-forming microorganisms in aqueous systems such as cooling water systems and pulp and paper mill systems, for controlling slime formation or microorganisms populations in aqueous bodies in general such as lakes and ponds. The method employs a combination of 2,2-Dibromo-3-nitrilopropionamide, called DBNP, and 3,3,4,4-Tetrachloro-tetrahydrothiopene-1,1-dioxide, available commercially as Diamond Shamrock DS-649. The combination is added to the particular system being treated in a quantity adequate to control the slime-forming microorganisms which are contained by, or which may become entrained in, the system which is treated. The weight ratio of the DBNP to the Diamond Shamrock DS-649 ranges from about 95:5 to about 35:65, either compound being present in such a quantity as to impart a synergistic behavior to the

composition as a whole. When the two ingredients are mixed, the resulting mixtures possess a high degree of slimicidal activity of the individual ingredients comprising the mixture. (Sinha-OEIS) W76-05531

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DETECTION DEVICES FOR USE IN SOLUTION PROCESSING SYSTEMS.

Water Purification Associates, Cambridge, Mass. C Calmon

U.S. Patent No. 3,928,200, 7 p, 8 fig, 2 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1783, December 23, 1975.

Descriptors: *Patents, *Water treatment, *Water quality control, *Water softening, *Demineralization, *Ion exchange, *Control systems, Automation, Scheduling, Monitoring.

A device is described for controlling the operation of a water softening system. The device detects certain points in the operating cycle such as the softening, the backwashing, the regeneration, and the rinse subcycles. The device is placed in contact with the processed solution at or near the system output so that the dimensional changes of the ion exchange material causes a flexing of the substrate material. This is used as a switch in the control circuitry for controlling the operating time of one or more of the subcycles of operation. The detector utilizes an ion exchange material in film, fiber or granular form placed on the surface of a relatively rigid but flexible solid material. The active ion exchange materials are applied to the surface of the solid material in their most expanded form. When the detector is in contact with solution containing multi-valent ions, the ion exchange material shrinks so as to cause the overall structure to deflect, or bend. The same detector can be used to determine the end of the rinse subcycle as the presence of mono-valent salt ions causes the ion exchange material to extend to its original posi-tion. (Sinha-OEIS) W76-05532

USE OF POLYMERIC QUATERNARY AM-

USE OF POLYMERIC QUATERNARY AM-MONIUM BETAINES AS WATER CLARIFIERS, Petrolite Corp., St. Louis, Mo. (Assignee). R. S. Buriks, and A. R. Fauke. U.S. Patent No. 3, 929, 635, 10 p, 3 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2233, December 30, 1975.

Descriptors: *Patents, *Water purification, :Water Treatment, Water Quality control, Water pollution control, Water pollution treatment, Suspended solids, Flocculation, Coagulation, Chemical reactions, Waste water treatment. Identifiers: Settling, *Betaines.

Water containing suspended particles is clarified by treating the water with polymeric quaternary ammonium betaines. It is described how polymers and copolymers of dicarboxylic anhydrides such as maleic anhydride are derived from copolymerizable compounds such as olefins, vinyl compounds, etc. The polymers cause rapid floccu-lation and reinforce the formed aggregates of particles causing a general tightening or bonding together of the initial particles and an increased rate of coagulation and settling. Clarification may take place either in a natural body of water or may take place in hydraulic thickeners of known design. Water to be treated may be of natural or artificial origin such as surface water, industrial water and/or sanitary water. The water may be treated during, or after use or prior to disposal. (Sinha - OEIS) W76-05544

WATER TREATING APPARATUS, Ecodyne Corp., Chicago, Ill. (Assignee). E. H. Dohnert. U.S. Patent No. 3,929,640, 4 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2234, December 30, 1975.

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Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, *Water softening, Flow control, Coagulation, Chemical reactions, Application equipment, Waste water treatment, Organic wastes.

A water treating apparatus is of the type well known in the art for softening water by the cold lime-soda ash process, and for the clarification of waters containing suspended solids, color, and orwaters containing suspended solids, color, and organic impurities by coagulation with alum or ferric sulfate or other coagulants. Coagulation and softening may be carried out simultaneously. The water treating apparatus is an open tank having a cylindrical side wall and bottom. A partitian within the tank defines a settling zone containing means for removing treated water. An uptake member defines a mixing and recirculation zone and has a lower opening. Upward directed nozzles are connected to an intake within the perimeter of the lower opening. Precipitates from a collecting zone are mixed with liquid passing through the nozzles and are passed into the mixing and recirculation zone. To soften water by this process, lime is added to precipitate the calcium bicarbonate as added to precipitate the calcium bicarbonate as calcium carbonate and the magnesium salts as magnesium hydroxide. Soda ash is added to react magnesium nydroxide. Soda ash is added to react with the calcium chloride and calcium sulfate originally present in the water as well as that formed by the reaction of lime with magnesium chloride and sulfate. A coagulant such as alum sodium aluminate, or ferric sulfate is employed in the treatment to assist in the separation of the tur-bidity and precipitates formed from the water. If sterilization and reduction in organic matter are required, chlorine is also used in the treatment. (Sinha-OEIS) W76-05547

VYREDOX-IN SITU PURIFICATION OF GROUND WATER, Stockholm Univ. (Sweden). Dept. of Geology. R. O. Hallberg, and R. Martinell. Ground Water, Vol. 14, No. 2, p 88-93 March-April 1976, 6 fig, 1 tab, 22 ref.

Descriptors: *Iron, *Manganese, Permeability, *Water treatment, Iron bacteria, Clogging, Aera-

Identifiers: *Vyredox method.

The abundance and relative purity of ground water guarantees its increase in usage. In some localities, the content of iron and manganese in ground water is so high that these metals must be removed be fore the water can be used for drinking or industrial purposes. Iron occurs in two states of oxidation in nature,-the divalent (ferrous) and trivalent (ferric) forms. The Vyredox method developed in Finland and used now in Sweden oxidizes the ferrous ion, which is soluble in water, to the ferric ion, which is insoluble, before the water, to the terminon, which is insoluble, before the water enters the well. The Vyredox method achieves a high degree of oxidation in the strata around the well. The method makes use of iron oxidizing bacteria and method makes use of iron oxidizing bacteria and aeration wells. A number of aeration wells are placed in a ring around the supply well. Water is forced down the aeration wells but first it degassed and then enriched with oxygen. The oxygen rich water provides a suitable habitat for the iron oxidizing bacteria which assist in the oxidation of ferrous iron. The process must be repeated at specific time intervals to avoid further increases of iron content. The process of precipitating iron in the aquifer has only a slight effect on aquifer permeability. Cloggage of the aquifer surrounding the well should not occur for a period many times longer than the life span of a typical well. Formulas provide estimates of the time in which aquifer cloggage can occur and the radius at which aeration wells should be placed. (Gass-NWWA) EXAMINATION AND REMOVAL OF IRON IN GROUNDWATER, Sunnittelukeskus-MKR, Helsinki (Finland).

For primary bibliographic entry see Field 5B. W76-05571

WATER CLARIFICATION SETTLER. Soviet Patent SU 446472. Issued May 16, 1975. Soviet Inventions Illustrated, Vol. W, No. 43, p D5, December 2, 1975.

Descriptors: *Patents, *Water treatment, *Sludge Descriptors: 'Patents, 'water treatment, 'Studge disposal, Sedimentation, Equipment, Treatment facilities, Waste water treatment. Identifiers: Sludge compression chamber, 'Clarification chambers.

A patent has been granted for a water clarification settler. The clarifier is partitioned and has a mul-tilayer charge in its upper section, while its lower section forms a sludge compression chamber. Clarification is accelerated with truncated conical baffles, located over the sludge compression chamber, on the center line of the unit. The baffles have their larger end up and are made with side ports. The lower section has clarified water inlets and a chamber filled with side ports. The lower section has clarified water inlets and a chamber filled with gravel to encourage agglomeration and to guide liquids to the multilayer charge area. Baf-fles with ports separate the clarification zones from the compression zones. Sludge is removed through channels and clarified water is removed through tubes. (Kramer-FIRL) W76-05578

EFFECT OF THE OPERATIONAL TEMPERATURE IN REVERSE OSMOSIS METHOD (GYAKU SHINTO HO NI OKERU SOSA ONDO

NO EIKYO),
For primary bibliographic entry see Field 5D.
W76-05592

THE SAFE DRINKING WATER ACT OF 1974: A MANAGEMENT IMPACT STATEMENT For primary bibliographic entry see Field 5G. W76-05656

REVERSE OSMOSIS PLANT HELPS CITY COPE WITH DIMINISHING GROUNDWATER SUPPLY,
Dacy (G. H.) Associates, Inc., Miami, Fla.

G. H. Dacy. Water and Sewage Works, Vol. 122, No. 12, p 70-73, December, 1975. 2 fig, 2 tab.

Descriptors: *Groundwater, *Water supply, *Reverse osmosis, *Water treatment, Municipal water, Florida, Pumps, Valves, Equipment, Costs, Water sources, Bracish water.

Diminishing supplies of groundwater forced the city of Venice, Florida, to consider alternate water sources. After considering various possibilities, the city chose a reverse osmosis plant that would draw on a supply of brackish water in the Upper Tampa/Lower Hawthorne strata. The supplier of the plant, Polymetrics, must test the plant and then install it in the city's new facilities. The Polymetrics reverse osmosis plant has membranes of eight inch duPont hollow fiber Permasep permeators that produce a nominal initial 14,000 gpd of that produce a nominal initial 14,000 gpd of desalted water per permeator. The primary elements of this system are well pumps, 5-micron prefilters, hex and acid injection pumps, high pressure pumps, permeators, reverse osmosis blocks and stages, block flow controllers, degasifier, product transfer pump and valve, permeator cleaning system, and electrical controls and instruments. The projected costs of 43.8 W76-05779

TORONTO'S APPROACH TO PREVENTIVE MAINTENANCE FOR TREATMENT PLANTS, Metropolitan Toronto Dept. of Works (Ontario). Water Pollution Control Div.

E. H. Baldock

American Water Works Association Journal, Vol. 16, No. 11, p 614-616, November, 1975. 1 fig.

Descriptors: *Computers, Equipment, *Waste water treatment, *Water treatment, *Maintenance, *Treatment facilities, Data collections, Canada.

Identifiers: Toronto(Ontario), Coding system.

Toronto's new program for preventive main-tenance of treatment plants employs a computer to administer the program. In order to prepare the computer, all the equipment of the vast plants had to be reinventoried, renumbered, and reviewed. A to be reinventoried, renumbered, and reviewed. A numbering system for all equipment, with provisions for additions, replacements, and exchanges, had to be devised. Initial data had to be collected on computerized forms. Processes and maintenance cycles had to be recorded. With the data supplied to the computer, it will print out, on a weekly basis, the list of components to be serviced at each plant for each week. The computer work order will list the component identification number, the level of maintenance required, a list of tools required for the function, and an estimated number of man-hours required for the task. A report of all work done will be stored in the computer. The article details the coding system used by the Toronto Department of Works. (Loustau-FIRL) FIRL) W76-05780

WATER FACTORY 21 IS THE FUTURE, Toups Corp., Santa Ana, Calif.
W. R. Mills, and L. J. Ewing.
Water and Wastes Engineering, Vol. 12, No. 11, p
34-36, November, 1975. 1 fig.

Descriptors: *Water treatment, *Water reuse, *California, *Water supply, Costs, Treatment facilities, Waste water treatment, Groundwater, Recharge, Saline water barriers, Recycling. Identifiers: Water Factory 21

Water Factory 21 is the first of a kind which injects a combination of desalted seawater and reclaimed waste water into the groundwater basin for domestic use. The combined capacity of 30 mgd will provide for the water needs of one tenth of Orange County, California, residents while providing the necessary design, construction, and operating technology for the future development of water supply factories. In addition, Water Fac-tory 21 supplies the 30,000 acre-feet of water necessary to create an effective fresh water barrier against seawater intrusion. The factory is made up of three separate facilities, a desalting plant, a waste water reclamation unit, and an underground basin. Present estimates indicate that costs of operation of Water Factory 21 will range from 32 to 38 cents per 1,000 gallons, a price comparable to the anticipated costs of supplying water from other sources. The facility recycles water and creates an easily expandable water source. (Loustau-FIRL) W76-05782

LIME RECOVERY AND REUSE IN PRIMARY

TREATMENT, Brown and Caldwell, Walnut Creek, Calif. For primary bibliographic entry see Field 5D. W76-05785

PROGRESS IN METHODS OF NITRATE REMOVAL, Department (England). of the Environment, Reading For primary bibliographic entry see Field 5D. W76-05805

Group 5F-Water Treatment and Quality Alteration

NITRATE REMOVAL FROM WATER BY ION EXCHANGE, Water Research Centre, Medmenham (England).

Medmenham Lab. R R Gauntlett.

Water Treatment and Examination, Vol. 24, Part 3, p 172-193, 1975. 5 fig, 5 tab, 13 ref.

Descriptors: *Ion exchange, *Nitrates, *Water treatment, *Groundwater, *Resins, Potable water, Nutrient removal, Economics, *Waste water treat-

Identifiers: *Nitrate removal.

Methods and results of nitrate removal from water with commercially available resins producing ion exchange are discussed in this paper. Effort been directed towards developing a resin specific for nitrate in preference to all other common anions found in potable waters including sulfate. For use in testing the continuous ion exchange loop system, resins R and S were used to obtain a conservative estimate of resin performance. In the continuous loop, resin is moved physically from the section where it is regenerated around to the treatment section where it becomes exhausted. From there it is moved around to re-enter the regeneration section, thus both steps occurring simultaneously and continuously. The loop was studied for the effect of the regenerant dose and the effects of the resin circulation rate. A good compromise between regeneration efficiency and nitrate removal was attained by using a dose rate of 0.75 g/min of salt in the water. The continuous loop was then compared with a fixed bed opera-tion and it was found that both systems gave equal nitrate removal, but the continuous loop produced water with a higher alkalinity and a lower chloride content. Ion exchange, as a method for removing nitrate from water, is a feasible method for giving acceptable water. Whether it will be economical compared with other nitrate-removal methods is not yet known. (Loustau-FIRL)

OLD SLOW SAND + NEW RAPID FILTRATION SEDIMENTATION = SAVINGS,

Camp Dresser and McKee, Inc., Boston, Mass. Thompson.

Water and Sewage Works, Vol. 122, No. 11, p 78-80, November, 1975. 4 fig.

Descriptors: *Sedimentation, *Filtration, *Water treatment, Treatment facilities, Control systems. Polymers, Polyelectrolytes, Filters, Turbidity, Massachusetts Identifiers: Alum, *Sand filtration.

In the new rapid sand filtration plant in Springfield. Massachusetts, the conventional sedimentation stage preceding filtration was eliminated because of the good quality of water from Little River. After conducting comprehensive studies, an environmental engineering firm determined that sedimentation could be eliminated when a chemi-cal was used for coagulation of solids during filtration. This resulted in a savings of \$2.5 million for the city. The new plant consists of influent metering and flow diversion works, mixing and conditioning basins, dual-media filters, wash water storage and pumping facilities, and a control building that houses the new laboratory facilities. It has a capacity of 60 mgd and could be expanded to 180 mgd. After tests were run to compare the performance of alum and polymer as coagulants in the filtration process, it was found that both worked equally well and polymer was cheaper than alum. Since the beginning of operation in November, 1975, the plant has been operating using a cationic polyelectrolyte at a dosage of about 1.4 to 1.5 mg/liter at filtration rates on the order of two to three gpm/sq ft. The filters have been routinely operated for one week between backwashes. No filter has yet shown excessive head loss or break-through of turbidity while continuing to deliver water of excellent quality. (Loustau-FIRL) W76-05808

DESIGN AND OPERATION OF HIGH-RATE FILTERS-PART 2, Montgomery (James M.), Inc., Pasadena, Calif.

Water Treatment Div. For primary bibliographic entry see Field 5D. W76-05831

DESIGN AND OPERATION OF HIGH-RATE

FILTERS--PART 3, Montgomery (James M.), Inc., Pasadena, Calif. Water Treatment Div.

S Kawamura

Journal American Water Works Association, Vol. 67, No. 12, p 705-708, December, 1975. 2 fig. 3 ref.

Descriptors: Hydraulics, *Filters, *Waste water treatment, *Water treatment, *Design criteria, Identifiers: Backwash, *High-rate filters.

The hydraulics on the backwash system of highrate filters are computed and discussed. Washwater troughs and underdrainage systems of the American fluidization back-wash and the European air-scour back-wash filter system are explained and compared. The author mentions his experimental development of a new type of filter bottom, but adds that in most cases there is little opportunity for experimental studies. The entire discussion and recommendations are addressed to the designer of filters. (See also W76-05831) (Loustau-FIRL)

W76-05832

EFFECT OF MUNICIPAL TREATMENT PROCESSES ON PU-239, PU-240, AND CS-137, Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

J. J. Alberts, P. J. Jehn, D. M. Nelson, J. S. Marshall, and M. A. Wahlgren.

In: Radiological and Environmental Research Division Annual Report-Ecology, January through December 1974. p 97-102, (1975) 1 tab, 4 ref. W-31-

Descriptors: *Environmental effects. *Plutonium. *Cesium, *Water treatment, *Sewage treatment, Water pollution, *Radioisotopes, Organic waste, Sludge, Illinois, Potable water, Public health. Identifiers: Chicago(Ill).

Water samples obtained from the Chicago Municipal Water Filtration Plant were analyzed to determine existing concentrations of Pu239, Pu240, and Cs137. Samples of the organic fertilizer, distributed to the public without charge at the Sanitary District, were obtained and similarly analyzed. It appears that very little Pu239, Pu240, is reaching the public through the drinking water source. The only possible source of high levels of radioactive materials could be particulate matter, which is efficiently removed through the filtration process. Although significant amounts of radioisotopes may be concentrated in the organic sludge at the sewage treatment plant, the material appears to be in a form that is not readily available for removal and is unlikely to remobilize. (See also W76-05879) (Chilton-ORNL) W76-05890

DESALINATION APPARATUS,

Zeoplant Co. Ltd., Osaka (Japan). (Assignee). For primary bibliographic entry see Field 3A. W76-05959

EVAPORATOR-CONDENSER UNIT UNIT FOR FROM

For primary bibliographic entry see Field 5D.

WATER PURIFICATION APPARATUS AND TIMING DEVICE FOR INITIATING A BACKWASHING CYCLE,

U.S. Patent No. 3,931,009, 5 p, 8 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 430, January 6, 1976.

*Water purification, Descriptors: *Patents. *Water treatment, Water quality control,
*Aeration, Filtration, Filters, Porous media,
Equipment, Waste water treatment. Identifiers: *Backwashing.

I p

The apparatus has an aeration chamber with openings to permit air to enter. Raw water is discharged in the form of a spray onto the top of a filter chamber located below the aeration chamber. If necessary chemicals are added to the water before it leaves the nozzles. The filter chamber has a circular trough extending around the top for receiving overflowing backwash water. The filter chamber is packed with a filter media consisting of several layers of different size aggregate. A collector in the form of a header is positioned in the layer of largest aggregate at the bottom of the filter chamber. The aerated and filtered water enters the collector header and from there is passes through a control valve into a treated water reservoir located below the filter chamber. When the reservoir is full, a float actuated switch deenergizes the raw water pump shutting off the plant. In order to backwash the filter media, a second header is positioned a short distance below to top of the filter media and connected to the collector header and a pressurized source of backwash water via a solenoid actuated valve. A timing mechanism is provided which energizes the solenoid valve to start the backwash operation for a predetermined duration in response to the number of times the reservoir has been filled and emptied, and the plant is then restored to normal operation. (Sinha - OEIS)
W76-05968

FILTER CLEANING METHOD.

Sterling Drug, Inc., New York. (Assignee). J. A. Meidl, and T. J. Vollstedt. U.S. Patent No. 3,932,278, 3 p, 1 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 942, No 2, p 885, January 13, 1976.

Descriptors: *Patents, *Water treatment, *Waste water treatment, *Filters, *Filtration, Water quality control, Cleaning, Chlorine, Ozone

Coatings form on water filters and sewage treatment plant effluent filters which prevent proper operation of the filters. If the filter media are treated with water that has dissolved in it a high concentration of chlorine or ozone, the coatings and agglomerations in the filter are readily removed. Ordinary chlorinated water, having less than about 25 ppm, is not effective. It is necessary to employ 'superchlorinated' water having a chlorine concentration between about 50 and 500 ppm. In the case where ozone is used, the effective concentration is between about 20 and 200 ppm. The chlorine or ozone can be introduced as a gas into the water prior to its application to the filter. Alternatively, the chlorine may be added to the water during the application of the water to the filter by applying to the filter surface a solid source of chlorine such as a hypochlorite salt, e.g. calcium hypochlorite, in amount sufficient to afford the required concentration of chlorine in the water. The optimum contact time between the chlorinated or ozonated water and the filter media lies between about 2 minutes and 1200 minutes, dependent upon the concentration of chlorine or ozone and the thickness of the coating. (Sinha-W76-05974

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media inutes. rine or SinhaMULTI-TANK ION EXCHANGE WATER TREATMENT SYSTEM, Rock Valley Water Conditioning, Inc., Rockford,

Ill. (Assignee). C. H. Yocum.

U.S. Patent No. 3,932,279, 5 p, 2 ref; Official Gazette of the United States Patent Office, Vol 942, No 2, p 886, January 13, 1976.

Descriptors: *Patents, *Water treatment, *Water purification, Water quality control, *Ion exchange, Demineralization, Resins, Instrumentation, *Waste water treatment.
Identifiers: Regeneration, Sensors.

Two or more ion exchangers are connected in parallel in a water system so as to provide relatively large treatment capacity. The invention provides means for electrically interlocking the exchangers to prevent more than one exchanger from regenerating at a time. The basic exchangers are of a well known construction and each in-cludes a tank containing a bed of ion exchanger resin. The interlocking is achieved in a relatively simple and versatile manner and enable any number of exchangers to be installed in the water system without increasing the complexity of the interlocking hardware. This is achieved by disabling sensors of each exchanger whenever any other exchanger is regenerating so that such a sensor is incapable of initiating a regeneration cycle even though regenerations is required. After an exchanger regenerates it is held in standby status and is automatically returned to service use when another exchanger begins its regeneration cycle. (Sinha-OEIS)

METHOD OF OPERATING ION EXCHANGE

SYSTEM,
Permutit Co., Paramus, N.J. (Assignee).
R. C. Adams.

U.S. Patent No. 3,933,631, 10 p, 20 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1344, January 20, 1976.

Descriptors: *Patents, *Demineralization, *Water softening, Water quality control, Water purification, *Ion exchange, Resins, Separation techniques, Equipment. Identifiers: Regeneration.

The invention utilizes an ion exchange system having at least four vessels, each of which contains a bed of ion exchange material that is in a different stage of exhaustion or regeneration from any other bed in the system. Valves and conduits connect the vessels in parallel with each other for primary service, or in series so that the downstream vessel acts as a polisher. The beds are exhausted and regenerated in sequence one after another by connecting various combinations of vessels to form different service and regeneration groups and thereby move the points where the fluid being treated and the regenerant or regenerants are introduced into the system. The number of steps in the exhaustion of each bed will depend on the number of vessels that are connected in parallel in service groups. Thus, by varying the number of vessels that are connected in parallel, the length of one of the steps in the service cycle may be made more nearly equal to the length of one of the regeneration steps, the amount of time during which any particular vessel is idle is reduced, and the amount of ion exchange material and the size or number of vessels needed are also reduced. (Sinha-OEIS) W76-05983

FLOCCULATION APPARATUS, G. E. Wilson

U.S. Patent No. 3,933,642, 5 p, 6 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1348, January 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Water treatment, *Flocculation, Water quality, Water pollution control, Coagulation, Velocity, Flow control, Equipment. Identifiers: Velocity gradient.

This process of flocculation utilized in water and wastewater treatment, as well as the chemical process industry, forms aggregates of particles by effecting contact between the particles by means of velocity gradient established in the fluid to be treated. The flocculation is carried out by mixing a coagulant, such as alum, with the fluid to be treated, such as water, and introducing the resultant mixture into the upstream end of a conductor. The conductor is capable of carrying the fluid and mixed coagulant from an upstream inlet end at a relatively high pressure head to the downstream outlet end at a relatively low pressure head. The conductor is comprised of a series of discrete pipe sections, each downstream section having a progressively larger diameter and length with diverging transition member connecting adjacent sections. The sizes of the sections and the transition members are carefully predetermined, as is the radius of curvature of the coil, in the event the pipe is wound, so as to afford a velocity gradient and flow condition throughout the length of the pipe yielding optimum results. (Sinha -OEIS) W76-05989

REVERSE OSMOSIS SEPARATION AP-PARATUS

Toray Industries, Inc., Tokyo (Japan). (Assignee). For primary bibliographic entry see Field 3A. W76-05990

APPARATUS FOR THE SEPARATION OF LIQUID MIXTURES MY MEANS OF PERMEA-BILITY SELECTIVE SEPARATION MEM-BRANES, Louis Schleiffer A. G., Feldbach (Switzerland).

(Assignee). For primary bibliographic entry see Field 3A. W76-05991

OUTBREAKS OF WATERBORNE DISEASE IN THE UNITED STATES, 1971-1972, Center for Disease Control, Atlanta, Ga. For primary bibliographic entry see Field 5C. W76-06138

5G. Water Quality Control

DECISION PERSPECTIVES ON UR STORM WATER POLLUTION, GKY and Associates, Alex., Va. For primary bibliographic entry see Field 5D. W76-05509

ENVIRONMENTAL CONSIDERATIONS IN RIVER BASIN PLANNING AND DECISION

Arizona Univ., Tucson, Inst. of Renewable Natural Resources.
For primary bibliographic entry see Field 4A.

RECENT TRENDS IN WATER QUALITY MANAGEMENT AND PROTECTION IN HUN-

MANAGEMENT AND PROTECTION IN HON-GARY, National Water Authority, Budapest (Hungary). Water Pollution Control.

Working Paper No. 15, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 8 fig, 21 p, 1 tab, 10 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *Water pollution control, *Management, *Planning, Data collections, Geography, Hydrology, Surface waters, Regions, Protection, Industries, Storage, Effluents, Water transfer, Streams, Oil pollution, Maps. Identifiers: *Hungary, Catchments, International planning, Diluting water, Reoxygenation.

Pollution control work in Hungary was started around 1950 by the collection of relevant data. These data were used in compiling a water quality map of the country. The quality survey provided the necessary information for planning work. It was realized, however, that a much greater volume of more frequent data is necessary for good planning. Data collection work has been decentralized, while processing work concentrated in a computer center. Round 200 000 data on about 5000 samples taken at 262 regular sampling about 5000 samples taken at 262 regular sampling points are presently entered annually on the data points are presently entered annually on the data files on suitable carriers. Water quality planning has been subdivided into three groups, namely: in-plant planning; regional planning; and interna-tional planning. In implementing these plans, a number of pollution control solutions have been adopted. The most important answer to pollution control is still effluent treatment so that especially in the case of industrial and trade effluents, the in the case of industrial and trade effluents, the need of rational in-plant industrial water management is emphasized, where water saving technologies have proved highly successful. Temporary storage and periodic releasing of such effluents was also found effective. Flow augmentation storage and releases of diluting water have also contributed to insuring the required water quality. As a method of pollution control, successful applications have been made of steam recovered. As a memor of pointing control, successful appu-cations have been made of stream reoxygenation; and finally, the aversion of accidental oil pollu-tions must also be mentioned here. (Bell-Cornell)

EMULSION BREAKING METHOD, Texaco Inc., New York. (Assignee).

U.S. Patent No. 3,928,194, 8 p, 7 tab, 2 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1782, December 23, 1975.

Descriptors: *Patents, Water pollution, *Oily water, *Pollution abatement, *Separation techniques, Water pollution sources, *Oil pollution, *Emulsions, Dispersion.

It is often necessary to separate the components of an emulsion of an oily material and water. This separation may be necessary in order to dispose of water without violating pollution regulations or to recover the oil for future use. A method for separating an oil and water emulsion into separate oil and water phases comprises converting the emulsion into a dispersion which will separate into distinct phases upon settling. The conversion to the dispersion is accomplished at ambient temperature by mixing with a demulsifier or by first the dispersion is accomplished at ambient tem-perature by mixing with a demulsifier or by first adding a demulsifier and a sufficient quantity of the material in the emulsified or non-continuous phase to effect an inversion so that the noncon-tinuous material becomes the continuous phase and then mixing this inverted emulsion until a dispersion is formed. (Sinha-OEIS) W76-05527

SYNERGISTIC COMPOSITIONS CONTAINING 2,2-DIBROMO-3-NITRILOPROPIONAMIDE AND 3,3,4,4-TETRACHLOROTETRAHYDRO-THIOPENE-1,1-DIOXIDE AND THEIR USE, Betz Labs., Inc., Trevose, Pa. (Assignee). For primary bibliographic entry see Field 5F. W76-05531

REMOVAL OF FLOATING POLLUTANTS. REMOVAL OF FLOATING POLLUTANTS, Shell Oil Co., Houston, Tex. (Assignee). E. V. Seymour, and R. R. Ayers. U.S. Patent No. 3,928,205, 3 p, 5 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1785, December 23, 1975.

Group 5G-Water Quality Control

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution treatment, Water pollution control, *Sorption, *Separation techniques. Identifiers: Pollutant recovery, Endless sorbent

An apparatus for removing a floating liquid pollu-tant or oil spill from a body of water consists of a tension member and a sorbent tube shaped as an open cylinder through which the tension member is placed. The sorbent tube has a lateral split so that it can be removed from the tension member. The sorbent bodies connected by the tension member form an endless belt which is deployed so as to position the sorbent tube in contact with the pollutants. They are then pulled by lines through a series of rotatable parallel cylinders or rollers which are placed consecutively closer together so that the pollutant is gradually removed over an ex-tended squeezing period. The pollutant is squeezed from the sorbent pads and falls into a funnel and containment means. (Sinha-OEIS)

APPARATUS FOR THE COLLECTION OF BUOYANT FOREIGN MATTER, F. A. O. Waren.

U.S. Patent No. 3,928,206, 5 p, 7 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1786, December 23, 1975.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution treatment, *Water pollution control, Overflow, Weirs, Valves, Turbulence, *Separation techniques. Identifiers: Floating weirs, Catamarans.

A collecting tank comprised of side walls and a rear wall and a substantially open bottom is sup-ported so as to float on a body of water with its upper edge above water level. Water is caused to flow into the collecting tank by means of a vaned impeller which extends between the side walls of the tank and is arranged for rotation about an axis positioned somewhat above water level. Oil or other foreign matter entering the collecting tank is retained by means of a non-return valve arranged downstream of the impeller. This valve is a plate extending between the side walls of the tank which is pivoted at one edge for movement about an axis is pivoted at one edge for movement about an axis positioned below water level. The other edge is supported so that it normally extends somewhat above water level by means of one or more floats. This non-return valve is so arranged that it can easily be depressed by the flow of water produced by the impeller so that there is nothing of the nature of a fixed weir over which the water would fall and thus produce turbulence. The impeller is arranged to cooperate with a floor member which extends below water level between the side walls of the tank with a rear edge positioned adjacent and below the periphery of the impeller and a front edge extending forward of the impeller. In operation a river of water and oil flows down over the floor member and in order to minimize the turbu-lence the entry velocity of the impeller vanes into the water is kept closely the same as the velocity of the water. (Sinha-OEIS) W76-05534

WATERCRAFT FOR SCAVENGING OIL SPIL-LAGE

G. M. Fletcher.

U.S. Patent No. 3,929,644, 5 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2235-2236, December 30, 1975.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution treatment, Water pollution control, Boats, Floating, Skimming, *Separation techniques, *Pollution abatement. Identifiers: Catamaran-type hull.

A self-propelled watercraft for scavenging oil spillage and other floating debris from the surface of a body of water such as harbor areas has a catamaran-type hull. This provides spaced apart hull sections each of which is equipped with a receiving tank having a substantial volume extending downward below the surface of the body of water. Each tank has an inlet located along and above a generally horizontal deck extending between the hull sections at the water level, and each tank also has an exit opening adjacent the bottom below the deck. The craft is open at its bow to define a mouth which permits a surface layer of the body of water to wash rearward along the deck toward the inlet openings of each tank as the craft is propelled through the water. The oil spillage and other debris is lighter than water and therefore floats while the water accumulations settle toward the bottom of the tank and are removed. Removal of water is effected by reducing the pressure at the exit openings via a venturi flow passage system associated with the exit openings and which reduces the pressure automatically as the craft moves through the water. (Sinha - OEIS) W76-05548

VVPFDOY.IN SITU PURIFICATION GROUND WATER.

Stockholm Univ. (Sweden). Dept. of Geology. For primary bibliographic entry see Field 5F.

PROTECTING GROUNDWATER FROM LAND-FILL LEACHATE,

Lycoming County Planning Commission, Williamsport, Pa. J. S. Walls, and R. E. Cummings.

Water and Sewage Works, Vol. 122, No. 12, p 68-69, December, 1975. 2 fig.

Descriptors: *Groundwater, *Waste disposal, *Public health, *Leachate, *Landfills, Lagoons, Laboratory tests, Environmental effects, Pennsyl-

Identifiers: Land application.

Several new elements to protect groundwater from leachate contamination have been designed for a sanitary landfill in Lycoming County, Pennsylvania. Because the BOD content of leachate is a danger to public health, the planners intend to collect the leachate and treat it biologically and chemically before recirculating it. The main feature of the design is a continuous multi-layer barrier separating the undisturbed existing earth from the landfill. From bottom to top, the barrier con-sists of a layer of sand, a 20-mil thick sheet of impermeable PVC, another layer of sand, and a layer of clayey soil. Sets of horizontal drainpipes above the plastic barrier will carry leachate away for treatment and recirculation. Laboratory tests have shown that the leachate strength can be lowered to acceptable levels through use of aeration to provide aerobic stabilization. The Lycoming system will consists of a 10 ft deep million gallon capacity lagoon with seven days retention time. Two 7 1/2 hp vertical aerators will initially furnish the neces-sary oxygen. The landfill should solve the solid waste disposal problems of a group of adjoining semi-rural counties. The initial rate of waste to be handled by the fill is estimated at up to 400 tons per day. (Loustau-FIRL)
W76-05599

PRECIPITATION MANAGEMENT FOR RECLAMATION OF OVERGRAZED AREAS IN ARID AND SEMI-ARID REGIONS, Colorado State Univ., Fort Collins. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 2B.
W76-05603

CONTROL OF NITROGEN TRANSFORMA-TIONS IN SOILS,

Iowa State Univ., Ames. For primary bibliographic entry see Field 5B. W76-05608

APPLICATION OF FACTORIAL ANALYSIS OF PRINCIPAL COMPONENTS TO THE CONTROL OF POLLUTION OF SURFACE WATERS,
Institut National de la Sante et (de) la Recherche

Medicale, Paris (France). For primary bibliographic entry see Field 5B. W76-05632

HOW TO GUIDE GROWTH IN SOUTHEAST-ERN NEW ENGLAND, PARTS I, II AND IV OF THE DRAFT REPORT.

New England River Basins Commission, Boston, Mass. Southeastern New England Study For primary bibliographic entry see Field 6G. W76-05649

HANLON CREEK ECOLOGICAL STUDY, PHASE R

Guelph Univ. (Ontario). Centre for Resources Development For primary bibliographic entry see Field 6G. W76-05650

STRUCTURING COMMUNICATIONS PRO-GRAMS FOR PUBLIC PARTICIPATION IN WATER RESOURCES PLANNING,

Utah State Univ., Logan. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 6B. W76-05652

A STUDY OF PROSPECTIVE WATER POLLU-TION CONTROL ACTIVITIES FOR THE OHIO RIVER VALLEY WATER SANITATION COM-MISSION (ORSANCO),

Wendell Associates, McLean, Va.

M Wendell

Available from the National Technical Information Service, Springfield, Va 22161 as PB-242 530, \$5.50 in paper copy, \$2.25 in microfiche. 68-01-2631. Prepared for the Environmental Protection Agency, Chicago, Illinois, March 1975. 88 p, 3 tab.

Descriptors: *Ohio River, Water Resources, *Planning, *Monitoring, *Watershed management, *Water pollution control, Water management, *Water manag ment, Pollution, Water quality control, River Basins Commission, Water quality control, Pennsylvania, West Virginia, Kentucky, Ohio, Indiana, New York, Virginia, Illinois.
Identifiers: *ORSANCO(Ohio River Valley Water Sanitation Commission), Ohio River Basin.

Orsanco, an eight state agency established by compact in 1948, has never had a thorough evaluation of its role, both present and perspective. The agency's central concern is the management of the Ohio River Basin. This concern should be broadened from concern about the river itself to include the entire watershed. Coordination is necessary and there are roles that cannot be carried out by the states or the Federal government. Several recommendations are made. A com-prehensive stream data collection and management system should be designed in order to discover sources of pollution, model streams, and aid in enforcement of water quality regulations. Data must be evaluated promptly and maintained in a data bank of water quality and related data for the Ohio River Basin. At the same time Orsanco should develop a water planning capability in cooperation with other agencies and perhaps undertake some projects on its own. Orsanco has a mission which cuts across state boundaries in areas such as stream modeling, development of consistent stream standards, achievement of equitable allocation of allowable waste loadings in streams of significance, provision of technical assistance, and preparation of annual information on the Ohio River Basin. No significant enforcement role is seen for this agency because of Federal dominance in this area. However, Orsan-co can offer expert testimony based on its moni-

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toring, and can serve as an interstate forum to toring, and can serve as an interstate forum to bring problems to focus and thus aid enforcement. It is stressed that resources should not be stretched too thinly, but should concentrate in pri-ority areas such as stream data system and planning efforts. A statement of Orsanco financing and staffing is given. (Smith-North Carolina) W76-05654

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rceof oniTHE SAFE DRINKING WATER ACT OF 1974: A MANAGEMENT IMPACT STATEMENT.
The American City, Vol. 90, No. 6, p 40-42, June 1975. 3 fig.

Descriptors: Federal government, *Legislation, Water quality control, *Water quality standards, Law enforcement, *Regulation, *Water policy, Non-structural alternatives, *Public health, Water management(Applied), Planning, Public rights, *Potable water.

Identifiers: *Safe Drinking Water Act of 1974.

The Safe Drinking Water Act of 1974 brandishes only the stick of federal regulation. The public will be expected to pay for increased services which underlines the importance of the public notification requirement of the act. Failure to inform consumers of contaminant levels, of inability to meet national standards, of inability to perform monitoring of variances and exemptions granted, and of non-compliance with prescribed schedules can result in fines. Continual notification may result in citizen apathy. Impact on water utilities seems negligible although administrative requirements may prove troublesome. Within two years of the effective date of the interim standards, all communities must have baseline analysis of water quality completed including testing for inorganic chemi-cals, pesticides, and total organic chemicals. These comprehensive tests are required annually for surface supplies. Those using groundwater must test every 3 years. Problems associated with the act include increased bureaucracy, high monitoring costs, lack of testing facilities, limited federal assistance and increased paper work. (Salzman-North Carolina) W76-05656

EFFICIENCY IN WATER QUALITY CONTROL FOR THE WILLAMETTE RIVER,

Oregon Univ., Eugene. Dept. of Economics. J. M. Friedman

The Annals of Regional Science, Vol. 9, No. 1, p 45-54, March 1975. 2 tab, 10 ref.

Descriptors: *Water policy, Water resources development, Planning, Economics, Economic efficiency, *Water quality control, *Cost-benefit analysis, *Alternative planning, Federal government, State government, Water quality standards, Flow augmentation, Chlorination, Oxygenation, *Oregon, *Waste assimilative capacity.

Identifiers: *Willamette River(OR), Dynamic pro-

Federal and state policies concerning effluent treatment are combined in planning for the future management of the quality of the Willamette River. The present water quality plans lack economic input. The current planning procedures for river water quality are described and evaluated and shortcomings are listed including the lack of cost-basefit analysis to determine mercical basefit. cost-benefit analysis to determine marginal benefit from improved water quality and the lack of cost minimization as an objective. Cost and efficiency criteria are established to develop water quality plans: identify alternative quality control techniques, determine relationship between technique and resulting water quality, and relate costs of techniques to water quality are outlined and the cost analyzed. These include increasing waste assimilative capacity by flow augmentation, oxygenation by aerators or adding molecular oxygen, or planning the time and place of discharge in keeping with water quality needs. Dynamic procost-benefit analysis to determine marginal benefit

gramming has been used to determine the optimal set of waste treatment activities and offers a valuable tool toward devising schemes for providing efficiency in planning. Costs, including social ones, can be reduced if all alternatives are considered. (Salzman-North Carolina) W76-05658

MANAGEMENT OF ENVIRONMENTAL QUALITY: OBSERVATIONS ON RECENT EXPERIENCE IN THE UNITED STATES AND THE UNITED KINGDOM,

North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning. M. M. Hufschmidt.

In: Economic Analysis of Environmental Problems, E.S. Mills ed. Universities-National Bu-reau Conference. Vol. 26, p 435-453, 1975. Com-ment by A.M. Freeman, p 453-460.

Descriptors: *Air pollution, *Water pollution, *Pollution abatement, *Environmental control, Cost-benefit analysis, Management, Costs, Benefits, Water management(Applied), United

Identifiers: *United Kingdom, *Environmental quality(EQ), National Environmental Policy Act of 1969, Environmental Protection Administra-tion, Standing Royal Commission on Environmen-

Environmental management policies of the United States and United Kingdom (UK) are analysed with a public investment framework employing an objective function including economic efficiency benefits, operation and maintenance costs, and enbenefits, operation and maintenance costs, and environmental quality (EQ) benefits with appropriate weighting. In 1970 in the US the National Environmental Policy Act was signed and the Environmental Protection Administration was created which formalized previous incremental efforts. Weighting of various objectives has been established through decision-making processes and EQ has become a national goal. In the UK concern for EQ is long standing, though not as intense. The creation of a Standing Royal Commission on Environmental Pollution and the issuance sion on Environmental Pollution and the issuance of a White Paper on environmental protection in 1970 outlined some problems, but only the first steps were taken. The UK's approach balances steps were taken. The UK's approach balances economic and technological benefits with the costs of environmental deterioration. Information on costs and benefits is scarce and thus judgements are subjective. Emphasis in the UK has been on more active use of existing laws which has made UK policy less striking than that of the US. There are other contrasts. In the US air quality concern led to the establishment of ambient air quality traderic and costral over new surveys where we have led to the establishment of ambient air quality standards and control over new sources, whereas the UK's long experience has been directed at controlling emission sources rather than achieving particular standards. Spectacular results have been achieved in some, but not all, areas. Similarly in the US water quality has been directed toward establishing and reaching standards, whereas the UK has concentrated on obtaining particular effluent levels at a reasonable cost. (Smith-North Carolina) Carolina) W76-05659

EFFLUENT DISCHARGE LAW-BURDENS AND CONSEQUENCES FOR THE PAPER INDUSTRY

))(ABWASSERABGABENGESETZ-BELASTU'S UND FOLGERUNGEN FUER DIE PAPIERIN-

DUSTRIE), Technische Universitaet, Darmstadt (West Germany). Wasser- und Abwasserforschungsstelle. H. L. Dalpke.

Der Papiermacher, Vol. 25, No. 11, p 181-185, November 22,1975. 1 fig, 8 ref.

Descriptors: *Legislation, *Foreign countries, *Water pollution control, *Pulp and paper industry, Effluents, History, Dissolved solids,

Biochemical oxygen demand, Chemical oxygen demand, Toxicity, Water quality control, Europe. Identifiers: *Germany, Settleable solids, Undissolved solids, Solids content.

A short history of effluent legislation is followed by a discussion of the proposed German antipollu-tion law and what effects may be expected on the paper industry. A short appendix explaining the concepts of undissolved solids, dissolved solids, settleable solids, BOD, COD, and toxicity is included. (Ward-IPC)
W76-05712

STATUS OF WATER POLLUTION CONTROL IN THE SOVIET UNION, Crown Zellerbach Corp., Camas, Wash. H. R. Amberg, I. Gellman, and R. H. Scott. Tappi, Vol. 58, No. 11, p 59-67; No. 12, p 71-75, Nov.-Dec., 1975. 5 fig, 4 tab.

Descriptors: *Water pollution control, *Foreign Descriptors: "water poliution control, "Foreign countries, "Pulp and paper industry, Waste water treatment, Treatment facilities, Water quality control, Governments, Water quality standards, Waste treatment, International commissions. Identifiers: "Soviet Union(USSR).

A 1975 visit to three selected pulp and paper mills in the Soviet Union (Krasnogorod, Kherson, and Syktyvkar) was undertaken under a cooperative agreement between the United States and Soviet governments, with the objective of determining the status of water pollution control in the Soviet Union and to ascertain if there were any problem areas which would lend themselves to cooperative programs by technologists of the two nations. This report includes descriptions of seven waste water treatment plants and information and observations obtained from meetings with paper industry ministry personnel and an agency responsible for the development and maintenance of water quality standards. Although there are some difference in the U.S. and Soviet practices, there appears to be a number of areas where cooperative programs would benefit both nations. (Sykes-IPC)

POSITION OF A CALCIUM BISULFITE PULP MILL PARTICULARLY WITH RESPECT TO INTENSIFIED ENVIRONMENTAL PROTECTION REQUIREMENTS (DIE POSITION EINER KALZIUMBISULFITFABRIK, BESONDERS IM WINBLICK AUF VERSCHAERFTE UMWELTSCHUTZFORDERUNGEN),

Helsinki Univ. of Technology, Otaniemi Finland. N.-E. Virkola.

Das Papier, Vol. 29, No. 10A, p V14-25, Oct. 1975. 18 fig, 7 ref, 7 tab.

Descriptors: "Water pollution control, "Pulp wastes, "Sulfite liquors, Water pollution sources, Europe, Closed conduit flow, Operating costs, Capital costs, Water pollution treatment, Biologi-cal treatment, Costs, Waste treatment, Wastes, In-dustrial wastes, Laboratory tests, Model studies, Pulp and paper industry, Bleaching wastes. Identifiers: *Sulfite pulp mills, *Finland, Kraft

mills, Scandinavia.

Sulfite pulp production in Finland will decrease considerably in the near future as many mills switch to the sulfate process. The reasons for this development are examined. An effort is also made to give an idea of the environmental pollution level of give an idea of the environmental position level of present and future suifate and sulfite mills. In addition, a model is presented for a sulfite pulp mill almost completely free of pollution. Measures required and investment and operational costs involved are described and compared with those of the minute of the property of the chemical and biological effluent treatment. The model is based on completely closing the bleaching and screening operations using the countercurrent principle. Laboratory and industrial-scale tests concerning the closing of the chlorination bleaching stage are reported. (Speckhard-IPC) W76-05729

Group 5G-Water Quality Control

DISTRIBUTION OF LIGNIN IN WATERS OF THE LOURIZAN INLET AS A MEASURE OF CONTAMINATION DUE TO DUMPING OF LIGNOSULFONIC LIQUORS RESULTING FROM PRODUCTION OF CHEMICAL PULP (LA DISTRIBUCTION DE LA LIGNINA EN AGUAS DE LA ENSENADA DE LOURIZAN, COMOMEDIDA DE LA CONTAMINACION A CAUSA DEL VERTIDO DE LEJUAS LIGNINSULFONICAS, PROCEDENTES DE LA FABRICACION DE PASTA DE CELULOSA),

A. Fernandez del Riego.

Boletin del Instituto Espanol de Oceanografia, No.
172, p 1-38, March, 1973. 5 fig, 16 ref, 1 tab.

Descriptors: *Pulp wastes, *Water pollution control, Water pollution, Wastes, Industrial wastes, Water pollution sources, Cellulose, Fibers(Plant), Waste water treatment, Waste treatment, Lime, Color, Waste dilution, Sea water, Flocculation, Organic compounds, Biochemical oxygen demand, Alkalinity, Aeration, Foreign countries, Lignins, Pulp and paper industry.

Identifiers: *Spain, Fiber recovery, Black liquors, Lourizan Inlet(Spain), Playa de Placeres(Spain).

It was found that pollution caused by the dumping of kraft pulp (black) liquors near the Playa de Placeres, Spain, could be reduced by recovering cellulose fiber in suspension and implementing improved biochemical purification in reservoirs. It was also found that lime treatment changes the color of the effluents from dark brown to clear yellow. Large-scale dilution of these treated effluents in sea water and consequent floculation of organic material decreased the BOD of the water. Alkalinity caused by the lime was eliminated through carbonation, by pre-aeration, and by the enormous diluting capacity of the sea water. (Sykes-IPC)

EFFECTIVE USE OF HIGH WATER TABLE AREAS FOR SANITARY LANDFILL. VOL. II, VTN, Inc., Orlando, Fla.

R. A. Beluche, G. I. Bergstrom, N. W. Hall, and W. McLellon.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-236 463, 86.00 in paper copy, \$2.25 in microfiche. Report No. EPA-530/SW-57d.I V.2, 1973. 134 p. 27 tab.

Descriptors: *Landfills, *Water table, *Leachate, *Data collections, *Groundwater, *Florida, Monitoring, Environmental effects, Physical properties, Chemical properties, Surface-groundwater relationships, Surface waters, Groundwater recharge, Phytoplankton, Periphyton, Standing crops, Algae, Bacteria, Invertebrates, Air temperature, Rainfall. Identifiers: Orange County(Fla).

This volume of the final report of a three year demonstration project on a landfill project in a high water table area in Orange County, Florida, contains all the data collected that were related to the environmental assessment of the project. Data were accumulated over a two year period after the initial refuse was deposited. The objective was to show that landfills in a high water table area could be engineered and operated with a minimal impact on the environment. This report consists of statistical tables giving physical and chemical data on surface water and test wells and include pH, alkalinity, acidity, dissolved solids, chlorides, hardness, phosphorus, phosphates, nitrogen, nitrates, nitrities, ammonia, temperature, turbidity, solids, sulfides, conductivity, sulfates, dissolved oxygen, chemical oxygen demand, calcium, magnesium, iron, aluminum, zinc, potassium, sodium, copper, carbon, carbon dioxide, carbonates, and methylene blue active substances. Monitoring results on phytoplankton, periphyton standing crops, algae in plankton and periphyton samples, macroinvertebrates; survival of selected microorganisms in leachate-containing groundwater (non adjusted and adjusted to pH 6.8-7.0), daily rainfall

and temperature; precipitation, and groundwater levels are compiled. Additional monitoring is planned for three more years. (See also W75-12111) (Buchanan-Davidson-Wisconsin).

LEGAL FRAMEWORK OF CO-OPERATION IN THE FIELD OF WATER MANAGEMENT BETWEEN HUNGARY AND HER NEIGHBORING COUNTRIES,

National Water Authority, Budapest (Hungary). For primary bibliographic entry see Field 6E. W76-05759

REHABILITATING AN 80-YEAR OLD SEWER

SYSTEM, Parsons, Brinckerhoff, Quade and Douglas, Inc., New York. For primary bibliographic entry see Field 5D.

W76-05764

INDUSTRIAL COST RECOVERY AND USER CHARGE ASSESSMENTS,

Bovay Engineers, Inc., Spokane, Wash. L. A. Esvelt, G. T. Clark, and R. James. Water and Sewage Works, p. 65-66, November 1974

Descriptors: *Cost repayment, *Public utilities, *Waste treatment, *Industries, Industrial wastes, Washington, Assessments, Rates, Storm water. Identifiers: User charges, Spokane(Wash).

The City of Spokane, Washington, has developed a formula for recovering that portion of the federal grant used for construction of facilities to handle industrial wastes and a method of equitably apportioning user charges according to industrial wastewater and flow characteristics. The industrial cost recovery system is based on those industries likely to discharge a 'processing' type effluent, and whose discharge is either greater in volume than 53 gal/hr on site employee shift/day or has wastewater constituent concentration significantly different from domestic sewage; an assessment system based on the cost of facilities construction per unit of sewage; an assessment system based on the cost of facilities construction per unit of flow, BOD, suspended solids and phosphorus; and assessments computed on a charge for wastewater flow at domestic waste strength plus a surcharge for BOD, suspended solids and/or phosphorus significantly in excess of domestic wastes. The user charge system consists of an equal service charge for all users representing the costs of providing for all users representing the costs of providing customer services, transporting and treating infiltration and inflow, transporting and treating stormwater, and a planned program for stormwater overflow elimination; a basic user charge for flow at domestic wastewater strength; a user charge adjustment for BOD, SS or phosphorus concentrations significantly different from domestic wastewater. The computations for cost recovery and user charges are given. (Auen-Wisconsin) Wisconsin) W76-05813

DETAILED ECONOMIC MODELS FOR INDUSTRIAL AND OTHER ACTIVITIES,

Bari Univ. (Italy).

Available from the National Technical Information Service, Springfield, Va 22161, as N75 13683, 84.00 in paper copy, \$2.25 in microfiche. Presented at the conference on Environmental Quality Management Models, by the Working Group on Regional Residuals, World Health Organization, October 22-25, 1974, Rotterdam, The Netherlands. 27 p. 6 fig., 77 fig.

Descriptors: *Environment, *Pollutants, *Econometrics, *Evaluation, Input-output analysis, Natural resources, Indicators, Intangible costs.
Identifiers: Environmental pollution, Accounting.

The economic analysis of environmental deterioration, although not defined by monetary transactions, must consider such 'commodities' as transactions, must consider such commodities as atmospheric oxygen used for combustion, water pumped from wells and rivers, sea water used for cooling, and generated residuals and wastes. This study proposes a waste accountancy to describe the flows of matter and energy from the environ-ment in a specific time interval and a specific region. The exchanges are presented in physical (natural) units, as weights of matter, energy units for heat, noise, radioactivity, and man-hours or man-years of labor in a conventional input-output matrix. It is postulated that some sort of an annual matrix. It is postulated that some sort or an annual gross physical product', corresponding to the monetary GNP, but describing the physical exchanges and flows of matter and energy through a region, could be developed based on the identification of environmental indicators through waste matrices. The comparison of economic-ecologic accountancies for the same region in different years would give information on the variation in the environmental waste load following changes in population, in population density, in consumption patterns, in raw materials, and in technological processes. The comparison of waste matrices for different regions could give useful information on the effects of environmental conservation policies under different economic and political conditions. (Auen-Wisconsin). W76-05817

EVALUATION OF QUALITY PARAMETERS IN WATER RESOURCE PLANNING: A STATE-OF-THE-ART SURVEY OF THE ECONOMICS OF WATER QUALITY.

Bovet (Eric D.) Alexandria, Va. E. D. Bovet.

Available from the National Technical Information Service, Springfield, Va 22161, as AD/A-005 225 \$9.00, in paper copy, \$2.25 in microfiche. Army Engineer Institute for Water Resources, Fort Belvoir, Va., IWR Contract Report 74-13, December 1974. 263 p. 11 fig., 199 ref. DACW 01-

Descriptors: *Reviews, *Planning, *Water quality, *Economics, *Water pollution, Costs, Water purification, Impaired water use, Benefits, Technology, Water allocation(Policy), Water management(Applied), Water quality standards, Surface waters, Water pollution sources, Pollutants, Water utilization, Model studies, Water supply, Waste water treatment, Waste disposal, Evaluation, Cost allocation, Optimization, Cost-benefit analysis, Economic efficiency, Financial feasibility, Water distribution(Applied), Groundwater resources, Cooling water, Recreation, Pollutant identification, Indicators, Industrial water, Municipal water.

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an Id

Identifiers: Water quality requirements, Water quality benefits.

To evaluate the economic aspects of water quality, literature was reviewed and results compiled. Chapter I contains approaches for analyzing and describing qualitative phenomena, the origins of water contaminants, and categorizes pollutants. Chapter II is devoted to a discussion of classifications and indices of water quality, water uses, effects and damages of water contamination, and water quality requirements and standards for specific uses. Water quality models are discussed in Chapter III. In many cases the purpose of models is to permit planners to determine the probable effectiveness of alternative water quality allocation or enhancement measures. Chapter IV is devoted to the technology and cost of water supply purification while Chapter V is concerned with the technology and cost of water and receiving-water purification. Chapter VI discusses water quality benefit measurement as based on two major methods: willingness-to-pay and substitution of alternative cost. Chapter VII reviews the economic techniques for optimal water supply purification and allocation and Chapter VIII considers economic techniques for the optimal solu-

tion of the pollution problem. Four problems are specifically discussed: waste disposal, effluent charges and control, receiving water quality management, and optimal waste treatment. (Auen-Wisconsin). W76-05818

MEASURING AND MINIMIZING THE SOCIAL COST OF ENVIRONMENTAL POLLUTION, Tennessee Univ., Knoxville. Center for Business and Economic Research.
C. B. Garrison, and H. W. Henry.
Available from the National Technical Informa-

Available from the National Technical Informa-tion Service, Springfield, Va 22161, as N74-22591, \$4.00 in paper copy, \$2.25 in microfiche. Report NASA CR-138118, January 1973. 85 p, 11 tab, 10 append. UT/NASA 43-001-021.

Descriptors: *Pollution abatement, *Industries, *Administrative decisions, *Economic impact, Industrial production, Costs, Water pollution, Air pollution, Measurement, Soil contamination, Legislation, Planning, Research and development, Return(Monetary), Investment, Pricing, Professional personnel, Social impact. Identifiers: *Environmental protection.

Fifty-three large, privately-owned corporations and the Tennessee Valley Authority provided information on the impacts of environmental protection on their corporate plans and actions. Most of these companies were in the automobile, petroleum, chemical, paper, non-ferrous metals, steel, and electric utility industries. Approximately 80% of the respondents had established a formal policy on 'environmental protection' and most policies were formalized during 1967-1971. The average capital expenditure per firm was \$14.8 million in 1971 and an estimated \$21.9 million in 1972. Some plant shut downs were reported as well as additions and deletions to product lines. A large increase in research and development spending was reported as well as the formation of many new staff and executive positions. The profitability of many firms has been reduced, but few price in-creases had been made due to competitive pressures. There was unanimous opposition to zero pollution legislation. The respondents believed that many conservationists, legislators, and concerned citizens lack knowledge and perspective about the many impacts and considerations in controlling environmental pollution in industrial operations. Industrial managers, too, may not un-derstand the full impact or the potential danger to the biosphere from combined effects of pollutants from many sources. The concensus was that pollution surveillance and control should be coor-dinated with involved local, state, and federal agencies. (Auen-Wisconsin). W76-05824

A TECHNIQUE FOR ENVIRONMENTAL DECI-SION MAKING USING QUANTIFIED SOCIAL AND AESTHETIC VALUES,
Battelle-Pacific Northwest Labs., Richland,

J. B. Burnham

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Report No. BNWL-1787 (UC-11), February 1974. 244 p. 54 fig., 23 tab., 26 ref.,5 append. AEC AT(45-1)1830

Descriptors: *Social values, *Aesthetics,
*Measurement, *Analytical techniques, Land use. Descriptors: Water quality, Biota, Air, Economics, Recreation, Public health, Safety, Nuclear power plants, Sites, Washington, Alternative planning, Correlation analysis, Regression analysis. Identifiers: Seattle (Wash).

Correlation and regression analyses were used to combine social values with techno-economic values inherent in site selection based on six hypothetical nuclear power plant designs/site op-tions and a set of rating scales for evaluating the acceptability of eight characteristics of each op-tion in two different geographical locations. Eight social value criteria, including economics, water quality, air quality, animal/plant life, cul-tural/recreational, health/safety, aesthetics and land use, were used as weighting factors. The sur-vey was administered to three Seattle population groups: environmentalists, high school students, and businessmen, and was designed to measure the respondents' direct weighting of the eight criteria by ranking each criteria in order of importance. The relative weights of the criteria were also measured indirectly by rating each (on a scale of one to seven) for each option and also making of one to seven) for each option and also making an overall judgment of the acceptability of each design option. A method was successfully developed to quantify aesthetics by fundamental equations expressing the relationships between viewscape quality and its basic components, and which is described in detail. The analyses indicated that near-maximum predictability could by achieved using as few as three of the eight impact achieved using as few as three of the eight impact categories as predictors of overall acceptability of the nuclear power plant. (Auen-Wisconsin) W76-05825

WILLINGNESS TO PAY AS A BEHAVIOURIAL CRITERION FOR ENVIRONMENTAL DECI-

SION-MAKING,
Waterloo Univ. (Ontario). Dept. of Man-Environment Studies.

Journal of Environmental Management, Vol. 3, No. 1, p. 29-41, 1975. 1 fig, 39 ref.

Descriptors: *Environment, *Decision making, *Social aspects, Social values, Methodology, Attitudes, Economics, Behavior, Market value, Pricing, Surveys, Pollution taxes(Charges). Identifiers: *Environmental quality, Willingness-

The economic nature of environmental quality questions and the inherent problems in the use of willingness-to-pay as a behavioral criterion for environmental managers is summarized. Development of an adequate theory or structure of social value which incorporates a variety of variables is necessary before attempting to apply economic techniques to environmental quality decisions, since environmental quality levels have little to do with market transactions or exchanges. Willingness-to-pay studies suffer from a lack of adequate information. Environmental damages are often perceived to be less than actually exist, and, in some cases, are concealed. Economic incentives for displaying, distorting, or hiding information also are important considerations, as is people's perceptions of their role in society.
Willingness-to-pay evaluations ignore those who are not directly involved and those of future generations, both of which groups may have a strong demand for high environmental quality. Problems in determining actual individual preferences, and in the use of prices are also considered. The use of surveys in willingness-to-pay analysis are subject to the disparity between what people say and what they wilniques. (Luedtke-Wisconsin) W76-05826

ENVIRONMENTAL IMPACT ASSESSMENT AS AN INSTRUMENT OF PUBLIC POLICY FOR CONTROLLING ECONOMIC GROWTH, Waterloo Univ. (Ontario). Dept. of Man-Environment Studies

For primary bibliographic entry see Field 6G.

PORT COLLECTION AND SEPARATION FACILITIES FOR OILY WASTES. VOL. 5. A COMPARATIVE ANALYSIS OF CONCEPTUAL SYSTEM PLANS FOR THE SURVEYED PORTS UNDER THE 'NO DISCHARGE', '1969 AMEND-MENTS' AND 'NO SHEEN' CRITERIA, Harris (Frederick R.), Inc., New York. For primary bibliographic entry see Field 5D. W76-05830

SALT TRANSPORT IN SOIL PROFILES WITH APPLICATION TO IRRIGATION RETURN FLOW, THE DISSOLUTION AND TRANSPORT OF GYPSUM IN SOILS, Colorado State Univ., Fort Collins. Dept. of

Agronomy.

or primary bibliographic entry see Field 5B. W76-05836

RESTORING THE QUALITY OF URBAN RECEIVING WATERS: INTERFACING UPGRADED TREATMENT FACILITIES WITH THE STREAM.

Clemson Univ., S. C. Dept. of Environmental Systems Engineering. or primary bibliographic entry see Field 5D.

MULTI-OBJECTIVE WATER RESOURCES PLANNING: METHODOLOGY TO ACHIEVE COMPATIBILITY BETWEEN ENVIRONMEN-TAL AMENITIES AND ECONOMIC DEVELOP-

Clemson Univ., S. C. Dept. of Environmental Systems Engineering. For primary bibliographic entry see Field 6B.

W76-05840

IMPACTS OF HYDROLOGIC MODIFICATION

ON WATER QUALITY, MITRE Corp., McLean, Va. J. Bhutani, R. Holberger, W. E. Jacobsen, P.

Spewak, and J. B. Truett.

Available from the National Technical Informa-tion Service, Springfield, Va 22161, as PB-248 523, \$13.00 in paper copy, \$2.25 in microfiche. Environ mental Protection Agency, Report EPA-600/2-75-007, April 1975, 530 p. EPA 1BB042 R802310.

Descriptors: Sedimentation, *Sediment control, Water quality, Runoff, Hydrology, *Water pollution control, *Construction, Impoundments, *Dredging, Forecasting, Reservoirs, *Sediment load, Suspended load. Identifiers: Soil loss.

The scope and magnitude of water pollution problems caused by hydrologic modifications (dams, impoundments, channelization, in-water construction, out-of-water construction, and dredging) are described. Types of pollutants released by each class of hydrologic modification are identified, and quantitative estimates are made of the amount of the major pollutant-sediment-hat enters by Nation's surface waters as a result of the amount of the major pointains—seaments that enters the Nation's surface waters as a result of highway and urban construction. Methods for controlling the release of pollutants from hydrologic modification activities are described, nydrologic modification activities are described, and the effectiveness of sediment control mea-sures is estimated. Two 'loading functions' are developed for predicting the quantities of sedi-ment released from construction operations of given magnitude and location. These functions are based on measurements of sediment yields and other parameters at 10 construction sites. The ac-curacy and limitations of the functions are analyzed. Measurement data from all classes of hydrologic modifications are reported in the 42 case studies of field projects summarized in the appendices. (EPA) W76-05866

INTERIM REPORT ON THE IMPACT OF PUBLIC LAW 92-500 ON MUNICIPAL POLLU-TION CONTROL TECHNOLOGY, Municipal Environmental Research Lab., Cincin-

For primary bibliographic entry see Field 5D. W76-05867

RECLAMATION OF SOILS CONTAMINATED WITH RADIOACTIVE STRONTIUM, Agricultural Research Service, Beltsville, Md. J. V. Lagerwerff, and W. D. Kemper.

Group 5G-Water Quality Control

Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1077-1080, November-December 1975. 3 fig, 3 tab, 13 ref.

Descriptors: *Land reclamation, *Strontium radioisotopes, *Leaching, *Radioactivity, *Soil contamination, Reclamation, Fallout, Radiochemical analysis, Environmental effects, Leachate, Radioactivity techniques, Chemical analysis, Analytical techniques, Soil management, Gypsum, Dispersion, Tracking techniques, Pollu-tants, Pollution abatement, Colorado, Soil treat-

Identifiers: *Radioactive strontium, Residual strontium, Specific adsorption, Agricultural soils, Evesboro loamy sand, Sassafras sandy loam, Fort Collins silt loam, Tagged soil, Strontium displacement. Exchange capacities.

Evesboro loamy sand, Sassafras sandy loam, and Fort Collins silt loam were treated with a mixed Ca-Sr solution to give about 95% saturation with Ca and 5% saturation with Sr. Samples of these soils were placed in acrylic cylinders and leached with 0.06 N CaCl2 to remove Sr. The leachings were mechanically controlled at various rates for different periods of time. Extracting the leached soil samples with 1N HCl yielded residual Sr equal to 0.43, 0.47, and 0% of the Sr exchange capacity of the Evesboro, Sassafras, and Fort Collins soils, respectively. There was general agreement between Sr concentrations measured at various depths and those calculated on the basis of the Lapidus-Amundson equation, especially so with heavier soils. The Evesboro and Fort Collins soils were also tagged with carrier-free Sr85 and. mounted in columns, leached with 0.06N solutions of either CaCl2 or SrCl2. The removal of Sr85 was more complete from the Evesboro than from the Fort Collins soil, and from the center than from the edge of the columns. Short-term leaching capability of SrC12 exceeded that of CaC12 where Sr85 was present in amounts small enough to be adsorbed mostly on specific soil adsorption sites. Where larger amounts of Sr85 had been adsorbed, Ca was equally effective as Sr in replacing the contaminant. (Henley-ISWS) W76-05906

EFFECT OF SURFACE APPLIED SULFURIOR ACID ON WATER PENETRATION INTO DRY CALCAREOUS AND SODIC SOILS

Arizona Univ., Tuscon. Dept. of Soils, Water and

Engineering.
T. A. Yahia, S. Miyamoto, and J. L. Stroehlein. Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1201-1204, November-December 1975. 3 fig, 4 tab, 8 ref.

Descriptors: *Soil treatment, *Calcareous soils, *Revegetation, *Infiltration, Penetration, Sulfur compounds, *Southwest U.S., Gypsum, Dispersion, Percolation, Soils, Calcium carbonate, Surface waters, Vegetation regrowth, Range management, Chemical wastes, Irrigation practices, Chemicals, Physical properties, Soil amendments, Acids, Alkaline soils, Reclamation, Soil structure, Soil moisture.

Identifiers: Range soils, Water penetration, *Sulfuric acid, *Acid treatment(Soils), Sodium saturated soils, Salt content, Playa soils, Stewart soils, Surface application, Soil particles.

Sulfuric acid, a surplus by-product of copper smelters in the Southwest, was studied to determine a possible role in reclamation and revegetation of calcareous and sodic range soils. The rate of water penetration into dry calcareous soils was measured in columns as well as boxes after concentrated (93%) sulfuric acid was applied to the soil surfaces. The rate of penetration increased with increasing acid application rates, but then decreased, with optimum application rates ranging from 5 to 15 metric tons/ha. Acid was especially effective in increasing the rate of penetration into sodium-affected calcareous soils. When acid was applied as a band on the soil surface, the wetting

front advanced in an elongated semicircular form with depth. Surface applied acid was more effec-tive than surface applied gypsum in increasing water penetration into sodium-saturated soils. Sulfuric acid may be useful for increasing water penetration into and subsequently aiding in revegetation of sodium-affected soils of semi-arid regions. (Henley - ISWS) W76-05907

THE ECONOMICS OF CLEAN WATER. VOLUME III. INDUSTRY EXPENDITURES FOR WATER POLLUTION ABATEMENT.

Conference Board, Inc., New York.

Available from the National Technical Informa tion Service, Springfield, Va 22161 as PB-231 147 \$5.50 in paper copy, \$2.25 in microfiche. EPA Report January 1972. 112 p. 74 tab., 5 append. 14-12-844.

Descriptors: *Industrial wastes, *Water pollution control, *Costs, *Industries, Capital costs, Operating costs, Projections, Waste water treatoperating costs, Projections, waste water tea-ment, Facilities, Sewage treatment, Water pollu-tion sources, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Hydrogen ion concentration, Heated water, Effluents, Geographical regions, Annual costs.

The efforts made to abate pollution by the food, textile, paper, chemicals, petroleum, rubber and plastics, and primary metals industries (which accounted for 92.3% of the water used and discharged in 1968 by all manufacturers) are defined by their expenditures for physical facilities, for operation, and the number of employees assigned to operate the treatment facilities. For the 1965-1969 period, 63% of the plants indicated that the greatest portion of expenditures was for construction of treatment facilities and only a small portion spent toward revising manufacturing processes. The expenditures made over the period represented at 4.4% radtio of gross capital investment for small plants and less than 1% for the largest establishments. The annual charge for pollution abatement represented a ratio to the cost of materials or the value of shipments of under 1% The reported daily discharge was 7.8 billion gal-lons of wastewater of which 92.9% of the total volume was discharged directly to surface waters and 5.0% flowed into public sewers, and required payment at the rate of \$91 per million gallons discharged wastewater. Inplant treatment represented a mean operation cost per volume of wastewater of \$73 per million gallons. Industry expenditures for the next five years are expected to double. (Auen-Wisconsin) W76-05951

PROCESS FOR SEPARATING OIL FROM EMULSIONS OF OIL IN WATER, For primary bibliographic entry see Field 5D.

APPARATUS FOR COLLECTING SURFACE PARTICLE ON BODY OF WATER,

L. Carter. U.S. Patent No. 3,931,740, 4 p, 9 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 942, No 2, p 710, January 13, 1976.

*Patents, pollution. Descriptors: *Water *Water *Floating, *Sampling, sampling. *Skimming, Water pollution sources, Water quali Flotsam, Air-water interfaces, Separation Identifiers: Floating particulates, Hydrofoils,

An apparatus for sampling and collecting floating particulate matter on the surface of a body of water has parallel, laterally-spaced, longitudinal tracking floats supporting a rigid tubular frame. Secured to the frame are two parallel, horizontal hydrofoil bodies spaces apart from each other to form an intake opening. A funnel-shaped net with its wide end secured to the intake opening and its narrow end terminating in a collecting screen collects surface particulate matter which is caused to flow into the intake opening as the apparatus is towed on a body of water. The lower hydrofoil body maintains the intake opening at a predeter-mined depth below the water surface, while the upper hydrofoil body enables the apparatus to ride over swells. In an alternative embodiment, a canvas sail is placed above the net to form an air capturing pouch which provides a lifting force to lift and maintain the net in an attitude generally paral-lel to the water surface. This attitude maintenance permits the skimming of a relatively thin layer of surface water and floating matter from the bulk water below. (Sinha - OEIS) W76-05970

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REMOVAL OF IMMISCIBLE FLUIDS FROM WATER SURFACES AND LAKE BEDS,

Electrolysis Pollution Control Inc., Minneapolis, Minn. (Assignee). C. E. Peterson.

U.S. Patent No. 3,933,632, 5 p, 8 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1344, January 20, 1976.

Descriptors: *Patents, *Oil pollution, *Oil spills, *Water pollution treatment, *Water pollution con-trol, *Water quality control, Adsorption, Iron ox-ides, Aluminium, Magnesium, Skimming. Identifiers: Mineral wool, Hydrophobic film, Natural stone

The invention provides for the removal of immiscible fluids by placing an adsorbant compound on the surface of the water. The adsorbant compound is an admixture of compacted lead slag mineral wool coated with a hydrophobic oil soluble film such as oleic acid, and between about 30% and 70% by weight of a finely divided natural stone containing substantial quantities of the oxides of iron, aluminum and magnesium such as trap rock, basalt or gabbro. The composition of the adsorbant compound is one which does not contribute to biological oxygen demand in the water being treated. The substances are highly inert, and are utilized for their highly adsorbant characteristics. The rate of adsorption is high, and the retention of adsorbed oily materials has also been found to be unusually high. An oil slick may be removed from the surface of a body of water by broadcasting the adsorbant compound upon the surface of the water and the oil slick will remain tightly adsorbed by the material over extended periods of time. The net affect is a reduction in the extent of pollution of the body of water. The coated or treated mineral wool assists in maintaining the material buoyant over extended periods of time, however it may be desirable or expedient to permit the adsor-bant material to remain on the water surface and permitted to ultimately settle to the bottom of the body of water while retaining the adsorbed pollutants. (Sinha - OEIS) W76-05984

RECOVERING BITUMEN FROM LARGE WATER SURFACES,

Great Canadian Oil Sands Ltd., Toronto (Ontario). (Assignee). H. L. Erskine

U.S. Patent No. 3,933,651, 3 p, 3 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1351, January 20, 1976.

Descriptors: *Patents, *Water pollution, Water pollution sources, "Water pollution treatment, Bituminous materials, "Separation techniques, 'Oil wastes, Skimming, Application equipment. Identifiers: Tar sands processing, Screen bottomed scoops.

The invention described is most useful in recovering floating bitumen from pond water from a hot water process for treating tar sands. In this

Water Quality Control—Group 5G

process a water effluent is removed from the hot processing area and is discharged into a setting pond. The water effluent comprises middlings material of depleted bitumen content which has undergone final treatment, sand tailings layer and other discharged water-containing fractions. The effluent is discharged to the upper portion of a sand pile zone and it percolates through the sand and collects in the pond. After standing a layer of and collects in the pond. After standing a layer of thick bitumen collects as a thick scum at the pond surface. The apparatus recovering the bitumen is comprised of a continuous conveyor belt; means for continuously rotating the belt from recovery area to discharge area; and screen bottomed scoops spaced along the outer surface of the belt. In operation the belt is set so that the scoops dip into the water at the recovery area immediately below the bitumen water interface. The belt is the below the bitumen water interface. The belt is then set into operation. The scoops dip into the body of water and carry water and bitumen up and away from the recovery area to a discharge area. As the belt passes between the areas, water drains through the scoop screening to the belt surface. The belt crown directs the water to the belt edge where it can be collected by troughs or merely discharged off. The belt can be provided with baffles to aid in deflecting the water sideward of the belt. (Sinha - OEIS) W76-05992

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ROLE OF PHENYLMERCURIC ACETATE ON STOMATAL REGULATION AND WATER LOSS IN PROSOPIS CINERARIA LINN,

Jodhpur Univ. (India). Dept. of Botany T. Mathur. Geobios (Jodhnur), 1(2/3): 48-52, 1974

Descriptors: *Stomata, Regulation, Spraying, Leaves, Transpiration, *Moisture deficit. Identifiers: *Phenylmercuric acetate, *Prosopis-

Investigations were carried out after the spray treatment with PMA (phenylmercuric acetate) and water on the adult and young plants of P. cineraria with regard to the stomatal regulation and consequent water loss and absolute water content in the leaves. They were examined at different durations after the above treatment. The water treated young plants lost very much water as their stomata remained widely open but less was lost in the adult plant. The percentage of absolute moisture remained more in PMA treated plants, when compared with water treated ones, as they transpired far more water than the former.—Copyright 1975, Biological Abstracts, Inc. W76-06011

BREEDING PLACES AND SEASONAL IN-CIDENCE OF AEDES AEGYPTI, AS ASSESSED BY THE SINGLE-LARVA SURVEY METHOD, World Health Organization, Dar es Salaam (Tanzania). East African Aedes Research Unit. Ramachandra T. Rao, M. Trpis, J. D. Gillett, C. Teesdale, and R. J. Tonn.
Bull W H O. 48(5): 615-622. 1973.

Descriptors: *Seasonal, *Mosquitoes, *Breeding, Insects, *Insect control, Rainfall. Identifiers: Aedes-Aegypti, *Tanzania.

The single-larva survey method was employed to study the breeding places and seasonal incidence of A. aegypti in Dar es Salaam, Tanzania. From May 1968-May 1969, 28,462 containers of water-May 1968-May 1969, 28,462 containers of water-located in approximately equal numbers indoors and outdoors-were investigated. The highest frequency of breeding (8.0%) of A. aegyplit wasobserved in tires and motor parts. Drums, barrels, water-pots and other receptacles left outdoors showed a higher frequency (3.1%) that hose kept indoors (6.6%). Metal containers were infested to a greater extent than those made of mud, wood or other materials, 2.5% of coconut shells, snail shells, etc. and 1.3% of tree holes, plant axils, and cut bamboos were infested. The seasonal prevalence, expressed as a container index, closely followed and paralleled the fluctuations in rainfall. The value of this survey method for both ecological studies and practical control purposes is discussed. Abstracts, Inc. W76-06033

INFLUENCES OF SOME FRESHWATER PLANTS ON THE DEVELOPMENT AND SURVIVAL OF MOSQUITO LARVAE IN BRITISH COLUMBIA,

Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences. P. D. C. Angerilli, and P. Beirne Can J Zool 52(7): 813-815. 1974.

Descriptors: *Canada, *Mosquitoes, Aquatic plants, *A *Algae, Larvae, Insect Chiorophyla.

Identifiers: Aedes-Aegypti, British Columbia, Callitriche-Palustris, Chara-Globularis, Elodea-Canadensis, Lemna-Minor, Nymphaea-Tuberosa,

Six species of freshwater aquatic plants and an alga (Chara globularis) (Characeae) collected in southern British Columbia (Canada) markedly reduced the number of adult mosquitoes (Aedes aegypti) emerging from experimental tanks by influencing larval development and survival. One of the plants (Lemna minor) and the green alga ap-parently produce juvenile hormone-like com-pounds, one species (Utricularia minor) ingests mosquito larvae, and two (Callitriche palustris and Nymphace tuberosa) operate by facilitating the presence and activity of predators of the larvae. -- Copyright 1974, Biological Abstracts, Inc. W76-06048

THE INTERNATIONAL LAW ASPECTS OF THE GARRISON DIVERSION PROJECT, For primary bibliographic entry see Field 6E. W76-06053

CONGRESS ORDERS MORITORIUM ON GAR-RISON DIVERSION UNIT. For primary bibliographic entry see Field 6E.

THE TAKING ISSUE: POTENTIAL OBSTACLE TO NATURAL RESOURCE MANAGEMENT LEGISLATION,

Oregon Univ., Eugene. School of Law. For primary bibliographic entry see Field 6E.

W76-06054

THE WASHINGTON SHORELINE MANAGE-MENT ACT, Geoffrey Crooks.

Oregon Law Rev, Vol 54, No. 1, p. 35-65 (1975), 31

Descriptors: *Water management(Applied),
*Permits, *Washington, *Resources development, Permits, "Washington, "Resources development, 'Legislation, Legal aspects, State governments, Local governments, Water law, Water resources development, Management, Planning, Natural resources, Resource allocation, Water quality, Water quality control, Water policy, Administration, Comprehensive planning, Environmental effects, Constitutional law, Eminent domain. Identifiers: *Washington Shoreline Management Act, *Coastal zone management, Coastal waters.

The Washington Shoreline Management Act The Washington Shoreline Management Act (SMA) is one attempt to legislatively control the course of development of Washington's coastal resources. The SMA is unusually broad in scope in that, it covers not only 'coastal areas' but also shorelines of various bodies of water, including many lakes and streams. Originally a substitute for a stricter law proposed by environmentalists, the SMA has created a regulatory scheme requiring an inventory of the state's shorelines and development of master programs designating the types of uses permissible for individual segments of those shorelines. To enforce its provisions the Act establishes a permit system requiring approval for many types of shoreline uses. Responsibility for enforcement of the Act rests primarily with local governments. The author sees potential constitu-tional problems with SMA's regulatory scheme in that a denial of a permit for the development of privately owned land may constitute an uncon-stitutional taking of that land. (Nursey-Florida) W76.0605

COASTAL ZONE MANAGEMENT AND INTER-

GOVERNMENTAL COORDINATION, Louisiana State Univ., Baton Rouge. Law School. For primary bibliographic entry see Field 6E. W76-06057

CORPS ISSUES INTERIM RULES FOR DISCHARGES OF DREDGED AND FILL MATERIALS. Environmental Law Reporter, Vol 5, No 9, p.

10143-10144 (1975). 4 ref.

Descriptors: *Dredging, *Federal Water Pollution Control Act, *Water pollution control, *Permits, *Regulation, Legal aspects, Legislation, Judicial decisions, Water law, Law enforcement, Federal government, State governments, Water pollution, Water pollution sources, Water pollution abatement, Water quality, Water quality control, Wetlands, Navigable waters, Discharge(Water), Pollutants, Water resources, Water conservation.
Identifiers: Administrative regulations, *FWPCA Amendments of 1972.

Interim rules for discharges of dredged and fill materials adopted by the Army Corps of Engineers are examined here in light of a court order inare examined here in light of a court order invalidating the previous rules and directing the
Corps to shoulder its full regulatory responsibility
under the Federal Water Pollution Control
Amendments of 1972. While the rules are lengthy
and complex, they establish a workable regulatory
program for the protection of watercourses and
wetlands from discharges of dredged and fill
metarisk Materials produced in present farming. materials. Materials produced in normal farming, silviculture and ranching activities are specifically excluded from these rules. Because of budgeting and manpower constraints, the rules will be implemented in three phases over a two year period. When fully implemented, the rules will encompass all waters subject to the Corps jurisdiction. Under the new rules, the states are to play a significant role in the protection of wetlands and watercourses. Thus the Corps will not issue a permit if the state in which the discharge will occur denies a water quality certification for the activity. (Nursey-Florida) W76-06061

ALASKA OIL POLLUTION REGULATIONS. In: 1974 BNA Environmental Rep. 706: 0621-22 (Alas. Ad. Code (AAC), Title 18, Environ. Conserv., Ch. 75, 1973) 2 p.

Descriptors: *Permits, *Alaska, *Oil pollution, *Oil, *Water pollution, Waste water(Pollution), Water conservation, Water permits, Water pollution, Control, water pollution sources, Water quality, Water quality control, Regulation, Legislation, Penalties(Legal), Legal aspects, State governments, Environmental control, Land, Soil conservation, Oil wastes.

The discharge of oil, asphalt, bitumen or residuary products of petroleum onto the lands of Alaska is herein prohibited unless a surface oiling permit has been obtained from the Department of Environmental Conservation. Persons attempting to stabil-ize soils with such petroleum products as tars, asphalt emulsions or oils are not exempt from the

Group 5G-Water Quality Control

surface oiling permit requirements. Construction of certain specified enumerated types of surfaces do not require a permit, provided that the construction of each surface does not result in the pollution of the land or waters of the state. Application for all such permits must be made on forms tion to all such permits must be made on forms prescribed by the department, and the granting or denial of such a permit is decided by the department after all necessary information is filed. Specific permit terms and conditions are applicable to all permits granted, including the prohibition of any application of petroleum derived dust retardants to wet surfaces, and the prevention of any oil runoffs from the surface receiving the application. Penalties for any violations include both fines and/or imprisonment. (Welch-Florida) W76-06062

STATE WATER QUALITY CONTROL FUND. In: 1975 BNA Environmental Rep. 721:0505-09 (Calif. Water Code). 5 p.

Descriptors: *California, *Water quality control, Loans, *Water pollution control, *Financing, Cost repayment, Credit, Capital, Debt, Regulation, Administration, State governments, Administrative agencies, Reviews, Legal aspects, Construction, Construction costs, Contracts, Priorities, Projects, Water contracts, Water costs, Reclaimed water, Reclamation.

Identifiers: Administrative regulations, Water reclamation

California has established a State Water Quality Control Fund to provide loans to public agencies to aid them in the construction of facilities for the collection, treatment or export of waste when necessary to prevent water pollution or for the reclamation of waste water and conveyance of reclaimed water. The State Water Resources Control Board herein outlines the application, processing and review procedures available to implement the utilization of the fund. Construction loans are available only upon a showing of a need of such loans to prevent pollution or where other monies are not available, and loans for up to onehalf of the cost of studies made by the public agency in connection with waste water reclamation are available when the study will provide needed in-formation and funds for such a study are otherwise unavailable. Representative sections of the regulation provide for: (1) loan contract condi-tions; (2) specified priorities of loan applications; and (3) review procedures by the state board of an action or failure to act by a regional board. The

DISCHARGE REPORTS AND REQUIREMENTS.

state board shall have power to issue subpoenas to require attendance of witnesses at such review

hearings. (Welch-Florida) W76-06063

In: 1975 BNA Environmental Rep. 721:0519-27 (Calif. Water Code). 12 p. 1 tab.

*California, *Waste Descriptors: disposal. *Disposal, *Water pollution control, *Water per-*Disposal, *Water pollution sources, Waste mits, Water pollution sources, Waste water(Pollution), Treatment facilities, Administra-water(Pollution), Treatment facilities, Waste water tion, Administrative agencies, Waste water disposal, Waste water treatment, Wastes, Water quality standards, Water quality, Environmental control, Legal aspects, Protection, Water law. Identifiers: Administrative regulations.

The California State Water Quality Control Board herein requires the filing of a report for every waste discharge or for a material change in a waste discharge previously filed and requires the pay-ment of a filing fee. A material change includes any addition of a major industrial waste discharge, a change in character of such a discharge, or any circumstances resulting in a material change of character, amount, or location of waste discharge. Flow volumes are checked by monitoring program reports, time schedule requirements for existing

discharges, and technical reports showing how excess volumes of effluent will be treated and disposed. Representative sections of the regula-tion provide for: (1) formulation of waste discharge requirements; (2) conditions and duration of waste discharge requirements; (3) monitoring, recording, and reporting of all orders containing waste discharge requirements; and (4) inspection to determine compliance. Cease and desist orders should be issued for any significant violation of waste discharge requirements or when any such violations are threatened. Furthermore, the discharger may be required to take appropriate remedial or preventive action. (Welch-Florida) W76-06065

CERTIFICATION OF CONFORMANCE WITH WATER QUALITY STANDARDS.
In: 1975 BNA Environmental Rep. 721:0530-32

(Calif. Water Code), 3 p.

Descriptors: *Permits, *California, *Water quality Descriptors: Permis, California, water quanty standards, "Inter-agency cooperation, Navigable waters, Water quality control, Water quality, En-vironmental control, Regulation, Administrative agencies, Federal Water Pollution Control Act, Waste disposal, Water resourses, Legal aspects, Permits, Taxes, Waste water(Pollution), Federalstate water rights conflicts.

Identifiers: Administrative regulations, Licenses.

All applicants for federal licenses or permits, and other persons who are required by federal law to obtain state certification that any discharge into navigable waters of the United States complies with applicable provisions of the Federal Water Pollution Control Act, as amended, shall submit their requests for certification to a California State Water Quality Control Board regional office. The application must contain all necessary information upon which a decision could be made plus any additional waste discharge information requested by the regional office. The regional recommendation, along with the information, must then be forwarded to the state board where a public hearing will be held if any activity poses a significant threat to the quality of navigable waters or where requested by the applicant. The executive officer of the state board will act upon the certification and provide a copy of the application and his recommendation to the regional office of the Environmental Protection Agency (EPA). Further-more, any application for certification by taxpayers who elect to take the deduction for amortization of water pollution control facilities under section 169 of the Internal Revenue Code of 1954. as amended, shall likewise be submitted to the regional EPA office through the state board. (Welch-Florida) W76-06066

MICHIGAN WASTEWATER REPORTING AND SURVEILLANCE FEES RULES.

Michigan Dept. of Natural Resources E. Lansing. Water Resources Commission. In: 1974 BNA Environmental Rep. 811:0541-43

(Mich Ad Code Part 9 1972, amended 1973). 3 p.

Descriptors: *Adoption of practices, *Michigan, *Waste water disposal, *Sewage, Administrative decisions, Water resources, Organic compounds, Inorganic compounds, Elements(Chemical), Oil, Salts, Gasoline, Sludge, Discharege(Water), Pipes, Conduits, Cooling water, Surface waters, Lakes, Rivers, Streams, Great Lakes, Permits.

Michigan has adopted rules governing Wastewater Reporting and Surveillance Fees. Under these rules a register of critical materials as initially compiled by the state water resources commission was to be published during October, 1971 with annual reports to be filed with the commission by every person doing business within the state who either discharges wastewater into the waters of the state, or who discharges wastewater in addition to sanitary sewage into a sewage

system. Furthermore, an interim report shall be filed if the use of critical material not previously reported is commenced during the year, or the ounts of critical materials discharged increase sufficiently to move the level of usuage into a higher category on the annual critical materials report. A person doing business in more than one location shall file a separate report for each location. Finally, the rules provide for an annual surveillance fee of not more than \$9,000 for each industrial or commercial location, such fees to be calculated and assessed according to this act. A person who contests a fee shall be afforded opportunity for a hearing thereon. (Segall-Florida)

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MICHIGAN WATER RESOURCES COMMIS-SION ACT.

In: 1973 BNA Environmental Rep 811:0101-05 (Act 245, Mich Pub Acts of 1929, as amended 1973). 5 p.

Descriptors: *Permits, *Michigan, Water resources, *Water quality control, *Water pollution control, Water pollution, Great Lakes, plains, Rivers, Streams, Discharge(Water), Flood-ways, Water quality, Water quality standards, Surface waters, Investigations, Flood control, Construction, Beach erosion, Obstruction to flow, Public health, Fish, Waste treatment, Groundwater. Sewage.

Michigan has enacted legislation establishing a water resources commission to protect and conserve the water resources of the state and to have control over all pollution of state waters. The commission may bring any appropriate action in the name of the people of the state to carry out the provisions of this act. The commission has the right to inspect any property for conditions that may cause pollution of state waters, and to establish pollution standards. In addition the commission has authority to control and regulate the use of flood plains. The legislation also sets forth rules and regulations concerning the discharge of liquid wastes into state waters. Provisions for permit issuance and for conducting hearings on alleged unlawful pollution of state waters are set forth. Any person who discharges any substances into the waters of the state in violation of this act is subject to fine. Finally, an annual surveillance fee is payable by any person or corporation discharg-ing water borne into any waters of the state. (Segall-Florida) W76-06068

REGULATIONS PERTAINING TO WASTE DISCHARGE PERMITS.

In: 1975 BNA Environmental Rep. 886:0527-30 (Ore. Ad. Rules Compilation Sects. 45-005 thru 45-

Descriptors: *Water quality standards, *Oregon, *Waste treatment, *Waste water disposal, *Permits, Effluents, Sewage disposal, Municipal wastes, Industrial wastes, Waste water treatment, Water quality control, Wastes, Regulation, Administrative agencies, Administration, Adoption of practices, State governments. Identifiers: Public hearings, *National Pollution Discharge Elimination System (NPDES) permit,

Public notice.

To enhance the quality of Oregon waters, all persons must obtain a permit before they discharge municipal or industrial wastes into state waters, municipal or industrial wastes into state waters, construct or alter a disposal system, discharge wastes from an existing disposal system, or construct any facility which would increase effluent discharges. Such state permits will not be required, however, if the person has already obtained a valid National Pollutant Discharge Elimination System (NPDES) permit. Despite this permit system, the regulation lists several types of wastes which may not be discharged into state waters under any circumstance. When a state per-

mit is desired, the person is first referred to another chapter of the statute for the procedural requirements in obtaining the permit. These regu-lations present the procedural steps and require-ments pertaining to the application for, issuance and revocation of a NPDES permit. Before any and revocation of a NPDES permit. Before any final determination is made concerning permit issuance, a tentative NPDES permit, listing effluent limitations, schedules of compliance and other special conditions, must be prepared for public dissemination. After allowing the public 30 days to make any comments, the final decision on the permit issuance may be made. (Hoffman-Florida) W76-06069

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DEPOSIT OF MOTOR VEHICLE BODIES AND ACCESSORIES INTO THE WATERS OF THE

ACCESSORIES INTO THE WATERS OF THE STATE.

In: 1975 BNA Environmental Rep. 886:0530-31 (Ore. Regs. Secs. 46-005 thru 46-035, 1970). 2 p.

Descriptors: *Permits, *Oregon, *Environmental control, *Environment effects, *Waste disposal, Oil, Fuels, Chemicals, Penalties(Legal), Water pollution sources, Streams, State governments, Administrative decisions, Water quality standards, Regulation, Legislation.

Identifiers: Motor vehicle denosits Glass disposal.

Before any motor vehicle bodies or parts are deposited into Oregon waters, a permit must be obtained from the Department of Environmental Quality. The application for this permit must contain the following information: (1) the name and address of the applicant; (2) the number of motor vehicle bodies or parts to be deposited; (3) the purpose and necessity for the deposit; (4) the name and location of the receiving body of water; and (5) the time schedule and method for the deposit of the vehicles. To protect the quality of state waters, any vehicles allowed to be deposited must be drained of all oil, fuel, chemicals and other potential pollutants. In addition, all glass and windows must be removed. Besides these minimum requirements, steps must also be taken to provide an desthetically compatible finished appearance after the vehicles have been completely covered and adequately secured. To assure the enforcement of these provisions, criminal penalties are provided for any violations. (Hoffman-Florida) W76-06070

REGULATIONS PERTAINING TO OIL SPILLS

INTO PUBLIC WATERS. In: 1975 BNA Environmental Rep. 886:0531-32 (Ore. Regs. Sec. 47-005 thru 47-030, 1972). 2 p.

Descriptors: *Cleaning, *Adoption of practices, *Oregon, *Oil spills, *Oil pollution, Water pollution sources, Penalties(Legal), Chemical, Water quality control, Water pollution, Disasters, Oily water, Environmental effects, State government, Legislating Paraplatics Legislation, Regulation. Identifiers: *Oil spill clean-up.

To protect the quality of state waters, Oregon has placed affirmative duties on any person having control over oil that is spilled into public waters. The person must immediately take steps to stop spilling, and must then proceed to collect and remove the oil. If collection of the oil is not feasible the person must take all practicable actions to contain, treat or disperse the oil. When proceeding contain, treat or disperse the oil. When proceeding with such actions, approval must be obtained from the Department of Environmental Quality before any chemical is used to aid in the cleanup. Any steps taken to control or collect the spill must be diligently carried outuntil the Department gives written notice that satisfactory cleanup is achieved. In addition to these duties, the person pure support and the person of must submit to the Department within seven days of the spill a full report describing the spill and the steps taken to avoid a recurrence. If the spill is determined to have been caused by the intentional or negligent conduct of the person having control over the oil, he shall be liable for a civil penalty of up to \$20,000. (Hoffman-Florida) W76-06071

CONFINED ANIMAL FEEDING OR HOLDING

OPERATIONS.
In: 1975 BNA Environmental Rep. 886:0532-35 (Ore. Regs. Secs. 51-005 thru 51-080, 1972). 4 p.

Descriptors: *Permits, *Oregon, *Confinement pens, *Domestic animals, Waste treatment, *Farm wastes, Farm management, Water pollution sources, Administrative agencies, Storage capacity, Drainage, Waste disposal, Engineering person-nel, Water quality control, Climatology, State government, Federal governments. Identifiers: Animal waste control facilities.

To protect the quality of the environment, any person planning to construct or operate a confined feeding or holding operation must receive approval for the proposed facility or operation from the Department of Environmental Quality. Any plan submitted for approval must contain informapian submitted for approval must contain informa-tion pertaining to location climatological data, the maximum number and types of animals to be con-fined, and several other specified factors. No ap-proval will be given to plans which will result in the discharge of wastes into state waters without a permit. To provide specialized expertise to the Council on a number of problems related to con-fined feeding or holding operations, a thirteen member advisory board is created which will include one member each from thirteen specified groups or organizations. These regulations also provide guidelines on a number of different facprovide guidelines on a number of different factors involved in the design including: drainage and waste volume control, collection and storage facilities, conveyance facilities and practices, disposal facilities and practices, and incidental control practices. When any of the above waste control facilities are sufficiently complex, the Department may require that detailed plans be prepared by a qualified engineer. Twelve different sources for such specialized design services are presented. (Hoffman-Florida)

STATE FINANCIAL ASSISTANCE TO PUBLIC AGENCIES FOR POLLUTION CONTROL FACILITIES.

In: 1973 BNA Environmental Rep. 886:0535-37 (Ore. Regs. Secs. 81-005 thru 81-050, 1971). 3 p.

Descriptors: *Oregon, *Costs, *Government finance, *Water pollution control, *Financing, Treatment facilities, Economics, Bond issues, Sewage treatment, Rates, Permits, Loans, Cost repayment, Capital supply, Administrative agentics, Paris 1, 1987. cies, Legislation.

To encourage the construction of water pollution control facilities, financial assistance from the state may be available for eligible projects. Reference is made to another Oregon regulation for a determination of what constitutes an eligible project. This regulation does define, however, what shall constitute eligible costs for control facilities. Any person desiring financial assistance must submit an application to the Department of Environment Quality which should include the fol-Environment Quality which should include the following documents: (1) a current Environmental Protection Agency federal sewage treatment works construction grant application form; (2) a resolution of the applicant governing body authorizing an agent to act on its behalf; (3) a five year projection of the applicants estimated revenues and expenses; (4) a resolution of the applicant's governing body establishing sewer user rates for the facilities to be constructed; (5) a legal opinion by the applicant's attorney concerning the applicant's authorization to enter into a loan or bond. purchase agreement. Factors to be considered by the Department when reviewing the application are set forth. If the application is approved, the Department may enter into a loan or bond purchase agreement in a principle amount not to exceed 70% of the eligible project cost. Detailed information pertaining to this agreement is presented. (Hoffman-Florida) W76-06073

SOUTH DAKOTA WATER POLLUTION LAW. In: 1974 BNA Environmental Rep. 911:0101-10 (South Dakota Compiled Laws, Ch. 46-25, 1973 and H. B. 567, Laws, 1974). 11 p.

Descriptors: *South Dakota, *Water quality control, *Waste treatment, *Water quality standard, *Permit, Classification, State governments, Administrative agencies, Discharge(Water), Toxins, Oil spills, Water pollution control, Wastes, Domestic water, Monitoring, Water permits, Papalize [1] [2] Penalties(Legal).

In order to prevent the adverse effects of water pollution, positive steps will be taken by South Dakota authorities to protect and maintain a high quality of water for domestic, agricultural and other uses. As a first step in achieving these goals, the Board of Emiroparental Partecisies hall ober the Board of Environmental Protection shall classify all state waters and shall promulgate applicable water quality standards. The Board shall also establish minimum requirements concerning the treatment of wastes. To insure that these requiretreatment of wastes. To insure that these require-ments are met, a permit must be obtained before any wastes may be lawfully discharged into state waters. The procedural requirements pertaining to the application for, issuance and revocation of such permits are set forth. Notwithstanding any permit, a list of toxic and dangerous discharges is presented which may not be discharged under any circumstances. If a permit is obtained, the Board retains the right to take prescribed steps to assure compliance with the permit requirements. These compinance with the permit requirements. Ites statutes also present provisions on a number of different topics including: the cleanup procedure for oils spilled into state waters, the procedural requirements in dealing with violations, the powers required for waste treatment management agencies, and state grants for water pollution con-trol facilities. (Hoffman-Florida) W76-06074

SOUTH DAKOTA ENVIRONMENTAL POLICY

In: 1974 BNA Environmental Rep. 911:0201-02 (South Dakota Environmental Policy Act, 1974). 2

Descriptors: *South Dakota, *Environmental effects, Environmental control, *Alternative planning, *Legislation, Natural resources, Water resources development, Projects, Administration, Administrative agencies, Planning, Decision making, Adoption of practices, Ecology, Public health,

State governments.
Identifiers: *Environmental Impact Statements, Public hearings.

South Dakota has enacted legislation to regulate water quality and to require impact statements. Before any agency approves a major action which may have a significant effect on the environment, it must prepare an environmental impact statement (EIS). This statement shall include the following information about the proposed action: (1) its description and environmental setting; (2) its short term and long term environmental effects; (3) its adverse effects which cannot be avoided; (4) any possible alternatine; (5) any irreversible commit-ments of resources which involve; (6) measures that could be taken to minimize adverse environthat could be taken to minimize adverse environ-mental effects; and (7) any growth-inducing aspects. The statement must also contain substan-tive comments received by the agency from the public concerning the proposed action. These comments will generally be in response to the draft EIS which must be prepared to give the public early notice of any proposed action. While the draft EIS need not be as detailed as the final EIS, it should follow the same basic format. Once the

Group 5G-Water Quality Control

final EIS has been prepared, it must be made available to the public for a specified time before any final decision is made. If the proposed action receives final approval, the approving agency must make an explicit finding that all the provisions of this Act have been met. (Hoffman-Florida)
W76-06075

SOUTH DAKOTA WATER QUALITY STAN-DARDS.

In: 1975 BNA Environmental Rep 911:0501-16 (Rules of Bd. of Environmental Protection; Art 34:04, Chs 34:04:02 thru 34:04:04, 1974). 16 p.

Descriptors: *Beneficial use, *South Dakota, *Water quality standards, *Waste water disposal, *Discharge(Water), Pollutants, Classification, Streams, Lakes, Toxins, Dissolved oxygen, Nitrates, Turbidity, Temperature, Suspended solids, Chlorine, Coliforms, Hydrogen ion concentration.

Identifiers: *Mixing zone.

To insure the quality of South Dakota waters, no pollutant may be discharged into a stream or lake if it will violate the beneficial use criteria of the receiving body. When testing these water bodies to insure compliance with prescribed criteria, discharges into a flowing water will be allowed a mixing zone. The minimum water quality standards for these mixing zones are set forth. Discharges into a lake, however, will not be entitled to a mixing zone. Regardless of the above provisions, no visible pollutants or toxic materials may be discharged into a lake or stream unless specifically authorized. When waters have been classified in one of eleven prescribed beneficial use classifications, steps must be taken to assure that the water body meets the water quality criteria of its classification. These criteria pertain to the following: total dissolved solids; nitrates; hydrogen ion concentration; coliforms; total chlorine residual; ammonia nitrogen; chlorides; total cyanide; free cyanide; dissolved oxygen; turbidity; temperature; suspended solids; total iron; and undisassociated hydrogen sulfide. Finally, all state streams aand lakes are assigned a beneficial use classification. (Hoffman-Florida) W76-06076

UTAH WATER POLLUTION CONTROL ACT. In: 1974 BNA Environmental Rep. 926:0101-04 (Utah Code Ann, 1953, Title 73, Ch 14, as amended by Ch 197, Laws, 1969; amended 1973). 4

Descriptors: "Utah, "Water pollution control,
"Water quality standards, "Permits,
"Administrative agencies, Control, Abatement,
Water pollution treatment, Waste disposal, Treatment facilities, Classification, Legislation, Legal
spects, Legal review, State governments, Waste
treatment, Public health, Administration, Water
types

Because of the public menace presented by water pollution, a water pollution committee has been created within the Utah division of health. To aid in the establishment of a comprehensive water pollution control program, the committee is granted numerous powers and duties, the most important of which include: the authority to classify state waters according to reasonable uses; the authority to establish state water quality standards; and the authority to exercise control over all waste disposal permit systems. These waste disposal permits will be required whenever individuals propose the construction, installation, modification or operation of any treatment works or other establishment which will result in the discharge of wastes into state waters. The procedural requirements relating to the issuance, denial, or revocation of these permits are set forth. Procedural requirements are also set forth concerning any actions taken by the committee pertaining to the

promulgation of water quality standards and the classification of state waters. Any individual who is adversely affected by any final decision of the committee may appeal to the appropriate district court. A further appeal may be taken to the state Supreme Court by any party to the action.

UTAH DEFINITIONS AND GENERAL REQUIREMENTS.

In: 1973 BNA Environmental Rep. 926:0501-03 (Code of Waste Disposal Regs. Utah State Dept. of Health, Part 1, 1965). 3 p.

Descriptors: *Utah, *Water quality control, *Waste water disposal, *Monitoring, *Permits, Design data, Effluents, Surface waters, Groundwater, Waste treatment, Irrigation water, Domestic water, Waste water, Treatment facilities, Water pollution, Water treatment, Chlorination.

To prevent wastes from being detrimental or hazardous to surface or ground water quality, all waste disposal systems must produce an effluent meeting specified quality requirements. Reference is made to another Utah statute for a full description of these quality requirements. To insure com pliance with the above provisions, the operator of the disposal system must keep daily records of the facility's operation to be submitted to the Utah State Division of Health at monthly intervals. The statute also requires that a permit be obtained be-fore any person constructs a device for the treatment or discharge of wastewater, except into an existing sewer system. A permit is also required for the construction of any individual wastewater system. Before these permits will be issued, the applicant must submit to the Division complete plans and specifications for the proposed con-struction. To provide maximum utilization of all resources, class 'D' effluents from these wastewater systems may be used for ridge or furrow irrigation of forage type crops, ridge or furrow irrigation of lawn areas not open to public access, water for hosing down wastewater treatment works equipment, and chlorinator injector water for wastewater chlorination facilities. Utilization of domestic wastewater sledge is also anticipated, although such utilization is subject to specified restrictions. (Hoffman-Florida) W76-06078

NEBRASKA LIVESTOCK WASTE CONTROL REGULATIONS.

In: 1975 BNA Environmental Rep. 836:0581-84 (Neb. Rules and Regs. Pertaining to Livestock Waste Control, Rules 1 through 11, 1974 as amended 1975). 4 p.

Descriptors: *Nebraska, *Farm wastes, *Water quality standards, *Livestock, *Treatment facilities, Waste treatment, Water pollution, Water treatment, Permits, Farm management, Waste disposal, Inspection, Legislation, Water pollution sources, Odor, Administration, Adoption of practices.

To enhance the quality of the state's environment, Nebraska promulgated these regulations to prevent the improper management of livestock wastes. To achieve this goal, all existing and proposed livestock operations must obtain a state construction permit and a NPDES permit whenever livestock wastes are discharged into state waters. Even if the wastes are not discharged into state waters, a state permit must be obtained if the discharged wastes create a nuisance, violate Nebraska Water Quality Standards, or violate the Nebraska Environmental Protection Act. The procedural steps and requirements pertaining the application for, issuance and revocation of these permits are presented. Whenever a state construction permit is required, the operator must install livestock waste control facilities which

hahave the approval of the Nebraska Department of Environmental Control. The type of facility which will be required largely depends on whether the facility will serve an open lot operation or a semi or totally housed operation. Once the facility has been approved, the operator is required to take specified steps to assure that all waste materials are properly disposed of, to assure the curtailment of odors, and to assure that no other pollution problems are created. Finally, the regulations provide for the periodic inspection control facilities. Hoffman-Florida) W76.06079

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TO AMEND THE WILD AND SCENIC RIVERS ACT (ON S. 10 AND S. 1004). For primary bibliographic entry see Field 6E. W76-06081

DESIGNATION AND DETERMINATION OF REMOVABILITY OF HAZARDOUS SUBSTANCES FROM WATER. Environmental Protection Agency. Washington.

D.C. Federal Register, Vol. 39, No. 164, p. 30465-30471,

Federal Register, Vol. 39, No. 164, p. 30465-30471, August 22, 1974.

Descriptors: *Environmental effects, *Administrative agencies, *Water pollution, Legal aspects, Federal government, United States, Navigable waters, Regulation, Water quality, Penalties(Legal), Water pollution control, Water pollution treatment, Water quality control, Pollutants, Pollutant identification, Water pollution effects, Toxicity, Chemical wastes, Water law. Identifiers: *Hazardous substances, Federal Water Pollution Control Act(FWPCA) Amendments of 1972, Administrative regulations, Coastal

waters, Contiguous zone.

Pursuant to the Federal Water Pollution Control Act Amendments of 1972, the Environmental Protection Agency hereby gives notice of intent to create new rules for the designation and deter-mination of removability of hazardous substances from water. The Administrator shall develop regulations designating as hazardous substances such substances which present an imminent danger to the public health when discharged into water. To be considered for designation as a hazardous substance, a reasonable potential for being spilled into a body of water must be present. In determining whether a hazardous substance may 'actually be removed' from the water, the substance must be normally removable from a body of water by physical, chemical or biological means. The fact that some other action may be possible to 'minimize or mitigate damages to the public health' does not make the substance 'actually removable' for purposes of these rules. Should it be determined that a substance is not 'actually removable', discharges of that substance may be subject to civil penalties. W76-06084

TIMBER PRODUCTS PROCESSING POINT SOURCE CATEGORY--EFFLUENT GUIDELINES AND STANDARDS.

Environmental Protection Agency, Washington, D.C.

Federal Register, Vol. 39, No. 166, p. 30891-30903, August 26, 1974. 13 p.

Descriptors: *Environmental effects, *Administrative agencies, *Lumber, Industries, Water pollution, Legal aspects, Water law, Federal government, Regulation, Water quality, Water pollution control, Water quality control, Water pullution treatment, Pollutants, Effluents, Water pollution sources, Saw mills, Economic impact, Technology, Control systems.

Amendments of 1972, Administrative regulations, Effluent limitations.

The Environmental Protection Agency hereby proposes effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources for the timber products processing point source category. The proposed regulation will amend present regulations by adding the wet storage subcategory, the particle board manufacturing subcategory, the sawmills and planing mills subcategory, the particle board manufacturing subcategory, and the insulation board manufacturing subcategory. The regulation requires that existing point sources achieve, by not later than July 1, 1977, effluent limitations which reflect the application of the best practicable control technology currently available, talso requires the achievement, by not later than July 1, 1983, of effluent limitations which represent the application of the best available, economically achievable, technology which will result in reasonable progress toward the national goal of eliminating all discharge of pollutants. New point sources must attain a Federal standard of goal of eliminating all discharge of pollutants. New point sources must attain a Federal standard of performance which reflects the greatest degree of effluent reduction achievable through the best available control technology, including a standard permitting no discharge of pollutants, where prac-ticable. (Nursey-Florida) W76-06085

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PLASTICS AND SYNTHETICS POINT SOURCE CATEGORY (PROPOSED EFFLUENT LIMITA-TIONS AND GUIDELINES).

Environmental Protection Agency, Washington,

Federal Register, Vol. 39, No. 184, Part 11, p. 33889-33908, Sept. 20, 1974.

Descriptors: *Classification, *Resins, *Regulation, *Water pollution control, *Plastics, Effluents, Legal aspects, Federal government, Legislation, Water law, Economics, Public health, Wastes, Water pollution, Water pollution sources, Water pollution abatement, Water quality control, Industrial wastes, Technology, Federal Water Pollution Control Act, Wastes, Resins, Polymers. Identifiers: Administrative regulations, Federal Water Pollution Control Act (FWPCA) Amendments of 1972.

The Environmental Protection Agency has given notice of proposed effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources for the plastics and synthetics manufac-turing point source category. The proposed regula-tion will amend 40 CFR (the Act), Part 416 by adding the ethylene vinyl acetate copolymers sub category, the fluorocarbons subcategory, the polypropylene subcategory, the alkyds and unsaturated polyester resins subcategory, the cellulose nitrate subcategory, the polyamides sub-category, the polyester resins subcategory, the silicones subcategory, the epoxy resins subcategory the phenolic resins subcategory, and the urea and melamine subcategory. The Act requires the achievement by July 1, 1977 of effluent limitations for point sources which require the application of the best practicable technology available. The Act also requires the achievement by July 1, 1983 of effluent limitations, which requires the achieving the achieving the sources of the subcategory. effluent limitations which require the application of best available technology economically achievable, and the achievement by new sources of a Federal standard which reflects the greatest degree of effluent reduction achievable through the application of the best available technology. (Nursey-Florida) W76-06086

WILLIAMS V. DUKE POWER CO. (SILTING OF STREAM, PONDS, AND LAKE). For primary bibliographic entry see Field 6E. W76-06088

MARINE CONSERVATION ACT, AMEND-For primary bibliographic entry see Field 6E

W76-06091

CALDWELL V. GOLDBERG (DISCHARGE OF EFFLUENT FROM SEWAGE PLANT INTO DRAINAGE DITCH). For primary bibliographic entry see Field 6E.

W76-06093

OLIVER V. HYLE (TERMINATION OF WATER AND SEWER SERVICES FOR FAILURE TO PAY ARREARAGES DENIAL OF DUE PROCESS).

For primary bibliographic entry see Field 6E. W76-06094

ENVIRONMENTAL PROTECTION AGENCY-POULTRY PROCESSING PRODUCTS, PROPOSED PERFORMANCE AND PRETREAT-MENT STANDARDS.

Environmental Protection Agency, Washington,

Federal Register, Vol. 40, No. 80, 18150-61 (1975). 12 p. 16 tab

Descriptors: *Industrial wastes, *Classification, *Federal Water Pollution Control Act, *Water quality standards, *Waste treatment, Waste water treatment, Regulation, Legislation, Methodology, Effluents, Pollutants, Water pollution sources, Wastes, Measurement, Standards, Ducks(Domestic). Identifiers: *Poultry wastes.

Pursuant to the Federal Water Pollution Control Act, the Environmental Protection Agency (EPA) is proposing effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources for the newly added chicken processor subcategory, tur-key processor subcategory, fowl processor sub-category, duck processor subcategory, and other processing subcategories of the meat products point source category. The general methodology used in developing the limitations, guidelines and standards are set forth. The poultry processing industry was divided into the above subcategories based on the following factors: type of raw materi-al; waste water characteristics; final product; and production process. Most of the waste water pollu-tants produced by these subcategories are the result of slaughtering and evisceration activities. Despite the different characteristics of these pollutants, the EPA has found that all raw wastes from all subcategories are amenable to measurement and characterization by the pollutant parameters. A description of the best practible control technology currently available and the best available technology economically achievable for each subcategory is set forth. Provisions are also presented concerning waste water control cost estimates and energy requirements. (Hoffman-Florida) W76-06096

NAVIGABLE WATERS PROCEDURES AND GUIDELINES FOR DISPOSAL OF DREDGED OR FILL MATERIAL.

Fed. Reg., Vol., 40, No. 88, 19766-94 (1975). 29 p.

Descriptors: *Navigable waters, *Dredging, *Classification, *Federal jurisdiction, *Alternative planning, High water mark, Regulation, Legislation, Jurisdiction, Bodies of water, Judicial decisions, Legal aspects, Tributaries, Adoption of practices, Administrative decisions. Identifiers: Aquatic vegetation line.

As a result of the decision in NRDC v. Callaway, public notice has been given of proposed regula tions pertaining to the disposal of dredged or fill materials into waters of the United States. In Cal-laway, the United States District Court overruled the Department of the Army's definition of 'waters of the United States' which had limited the scope of the Department's jurisdiction to 'navigable waters' of the United States. Since this definition was deemed too narrow, four alternative regulations have been proposed which contain a broader definition of 'waters of the United States'. They are: (1) that the Department's jurisdiction be extended to almost every coastal and inland artificial or natural waterbody up to the highwater mark or to the aquatic vegetation line. highwater mark or to the aquatic vegetation line;
(2) that it be extended over coastal waters to either the mean high water mark or the salt water vegetathe mean high water mark or the sait water vegeta-tion line, and over inland waters to all navigable waters and their primary tributaries up to their headwaters; (3) that jurisdiction be the same as in alternative one, with a different permit system to cover non-navigable waters of the United States; and (4) that jurisdiction be the same as in alterna-tive two, with some changes in the permit system. (Hoffman-Florida) W76-06097

WATER QUALITY STANDARDS: OREGON (WITHDRAWAL OF PROPOSED RULE MAK-ING).

Environmental Protection Agency, Washington, 39 Fed. Rep. 43557-58 (1974), 2 n.

Descriptors: *Dissolved oxygen, *Water quality standards, *Oregon, *Saturation, *Federal Water Pollution Control Act, Water quality, Air, Dams, Spillways, Eutrophication, Fish, Supersaturation, Washington, Idaho, Standards, Aquatic life, State governments, Pollution abatement.

This notice withdraws the notice of proposed ru-lemaking in which the Environmental Protection Agency (EPA) proposed to set out water quality standards for total dissolved gas for the State of Oregon. The main cause of excessive total dissolved gas pressure, which has a detrimental effect on aquatic organisms, is supersaturated waters from the spillways of dams. As water passes over the top of the spillway, air is forced into solution and supersaturation results. A water and supersaturation results. A water quality standard setting total dissolved gas criteria decreases in stringency as it exceeds 100 percent saturation. Oregon's water quality standard for total dissolved gas is 105 percent saturation. The EPA, believing that the 105 percent saturation for total dissolved gas was unreasonably stringent and unachievable, proposed a 110 percent standard. However, since the Federal Water Pollution Control Act gives states the right to adopt and enforce state standards that are more stringent than Federal standards, the EPA has decided to withdraw its notice of proposed rulemaking. (Segall-Florida) W76-06098

STREAM POLLUTION CONTROL BOARD OF STATE OF INDIANA V. UNITED STATES STEEL CORP. (COMMON-LAW PUBLIC NUISANCE ACTION AGAINST STEEL CORP. IN WHICH PRIVATE CITIZEN SOUGHT TO INTERNEMENT. INTERVENE.

For primary bibliographic entry see Field 6E. W76-06106

RESERVE MINING CO. V. ENVIRONMENTAL PROTECTION AGENCY (ACTION BY U. S. AND MINNESOTA TO PREVENT DISCHARGE OF TACONITE TAILINGS INTO WATER OF LAKE SUPERIOR BY PROCESSING COM-PANY).

For primary bibliographic entry see Field 6E. W76-06107

UNITED STATES V. LEWIS (ACTION TO EN-JOIN CONSTRUCTION OF A CAUSEWAY ACROSS A TIDAL MARSH WITHOUT PERMIT REQUIRED UNDER THE RIVERS AND HAR-BORS ACT). For primary bibliographic entry see Field 6E. W76-06108

Group 5G-Water Quality Control

COMMONWEALTH, DEPARTMENT OF NATU-RAL RESOURCES V. WESTMORELAND-FAYETTE MUNICIPAL SEWAGE AUTHORITY (APPEAL BY MUNICIPAL ENTITY FROM ORDER TO CURB DISCHARGE OF UN-TREATED SEWAGE INTO WATERS OF PENNSYLVANIA.,

For primary bibliographic entry see Field 6E.

EURASIAN WATER-MILFOIL IN MICHIGAN, Auckland Univ. (New Zealand). Dept. of Botany. B. T. Coffey, and C. D. McNabb. Mich Bot. 13(3) p 159-165, 1974.

Descriptors: *Michigan, Great Lakes, Lakes, Her-bicides, Viruses, Submerged aquatic plants, Nuisance algae, Water pollution control. Identifiers: Ceratophyllum-Demersum, Chara-Sp. Elodea-Canadensis, *Eurasian(Water-milfoil), *Myriophyllum-Spicatum, Najas-Sp. Potamogeton-Simplifolius, icana, Budd Lake(Mich). Vallisneria-Amer-

Myriophyllum spicatum has become common in the Great Lakes region, and is a considerable nuisance. The history of its introduction into the country is reviewed. Control measures including herbicides and the effects of a natural virus are discussed. Plant communities in Budd Lake are discussed; major associated in these communities are Vallisneria americana, Chara sp., Potamogeton amplifolius, Najas sp., Elodea canadensis, Ceratophyllum demersum.--Copyright 1974. Biological Abstracts, Inc. W76-06149

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

RESERVOIR MANAGEMENT VIA RELIABILI-

TY PROGRAMMING,
Politecnico di Milano (Italy). Istituto di Elettrotecnica ed Elettronica

For primary bibliographic entry see Field 4A. W76-05508

ENVIRONMENTAL CONSIDERATIONS IN RIVER BASIN PLANNING AND DECISION

Arizona Univ., Tucson, Inst. of Renewable Natural Resources

For primary bibliographic entry see Field 4A. W76-05510

THE ROLE OF INLAND NAVIGATION IN RIVER BASIN DEVELOPMENT.

Magyar Tudomanyos Akademia, (Hungary). For primary bibliographic entry see Field 4A. W76-05511

SYSTEMS APPROACH TO RIVER BASIN AND INTERBASIN DEVELOPMENT,

Washington Univ., Seattle. For primary bibliographic entry see Field 4A. W76-05512

UNCERTAINTY IN DECISION MAKING, IN WATER RESOURCES

Water Resources Center, Budapest (Hungary). I. Bogardi.

Working Paper No. 10, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 8 fig, 30 ref. (United Nations, Department of Economic and Social Affairs)

Descriptors: *Risks, *Water resources, *Decision making, *River basin development, Water management, Economics, Stochastic processes, Costbenefit analysis, *Optimization, Equations, models. Mathematical Systems analysis. Methodology.
Identifiers: Multiobjective planning, Developing

countries.

Optimum decision making in river basin develop-ment should consider the uncertainties due to natural phenomena (natural uncertainty), insuffinatural phenomena (natural uncertainty), insufficient information (sample uncertainty), and the limited understanding of natural, technological and economic processes (model uncertainty). Non-optimum decisions may cause economic losses and/or adverse social and political effects in the economy of any nation, especially in develop-ing countries. In this line, the use of modern decision-analysis methodology is recommended in order to reach optimum decisions under the vari-ous uncertainties mentioned. Principles of such methods are emphasized without the strict mathematical formulations which are available in the literature cited. However, results of the use of various methods are shown. The task of applying decision sciences to river basin development in developing countries in the face of limited data (hydrologic, economic, etc.,), funds, technology and manpower is a difficult one, but it is hoped that this paper will provide some guidelines for this purpose. (Bell-Cornell) W76-05513

A CASE STUDY REPORT ON THE VISTULA RIVER BASIN,

Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering. For primary bibliographic entry see Field 4A. W76-05514

THE OUT-OF-KILTER ALGORITHM SOME OF ITS APPLICATIONS IN WATER RESOURCES, Technical Univ. of Warsaw (Poland). Inst. of En-

vironmental Engineering.

J. Kindler. Working Paper No. 12, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 28 p, 4 fig, 10 ref, append. (United Nations, Department of Economic and Social Affairs)

Descriptors: *Water resources, *Management, *Water allocation(Poligy), *Linear programming, Computer programs, *Algorithms, Networks, Computer programs, *Algorithms, Networks, Flow, Circulation reservoirs, Storage, Pumping. Flow, Canding, Equations, Planning, Equations, Systems analysis.
***-orifiers: *Out-of-kilter algorithm,

Although conventional techniques are inadequate to plan and formulate complex water resources systems, given the many variables, inputs and outputs, the 'system approach' provides water resources planners with a much better set of tools than were available 10 to 15 years ago. In a Case Study Report on the Vistula River Basin (Working Paper No. 11 of UNDP/UN Seminar), reference was made to the so-called Water Resources Management (WRM) Model developed and applied in the framework of the UNDP/UN spon-sored 'Vistula River Project.' Although this paper is not a complete description of the WRM Model, it provides illustration of one of its most important parts, the out-of-kilter algorithm. Presented is a comparatively simple water resources allocation model based on Fulkerson's out-of-kilter algorithm. It is a special purpose linear programming method which has been efficiently used for solution of a number of water resources problems. The model is presented in the form of a complete computer program OKAY written in the Fortran language. Potential applications of the model are illustrated by a few computational examples. Although

in principle this is an allocation model for a single time period, the possibilities of its extension to multiperiod analysis are also briefly discussed. (Bell-Cornell) W76-05515

RIVER BASIN MODELS AND THEIR APPLICA-TION WITH SCARCITY OF DATA.

World Meteorological Organization, Geneva

(Switzerland) For primary bibliographic entry see Field 4A.

A REVIEW OF SOME HYDROLOGICAL STU-DIES REQUIRED IN THE DESIGN OF WATER MANAGEMENT PROJECTS.

World Meteorological Organization, Geneva (Switzerland).

For primary bibliographic entry see Field 4A. W76-05517

WATER RESOURCES DEVELOPMENT IN THE TISZA RIVER BASIN AND ITS IMPACT ON SOCIO-ECONOMIC GROWTH. Water Management Center, Budapest (Hungary).

Dept. of Long Range Planning. For primary bibliographic entry see Field 4A. W76-05519

VIEWS ON RIVER BASIN DEVELOPMENT IN THAILAND.

Bangkok Metropolitan Water Works Authority (Thailand). For primary bibliographic entry see Field 4A. W76-05520

MINIMIZING THE OPERATING AND CAPITAL COSTS OF WATER SUPPLY PROJECTS, Claremont Men's Coll., Calif. Dept. of Mathematics.
J. B. Lucke.

Available from the Microfiche from American Geophysical Union, Wash., D. C. 20006, for \$1.00. Document 76-002. Water Resources Research, Vol. 12, No. 1, p 101, February 1976.

Descriptors: *Water supply, *Projects, *Operating costs, *Capital costs, Algorithms, Networks, Dams, Mathematical models, Systems analysis, Dynamic programming, Optimization. Identifiers: *Cost minimization.

Sequencing the expansion of water supply projects to minimize discounted operating and capital costs can be formulated graphically as finding a least cost path from the present to the fully expanded future. Considered herein are four alternate contractions are supplied to the solutions in the solution in the solutio ternate assumptions concerning the relationships of operating costs and production. A simple dynamic programming algorithm or minimal cost network algorithm can be readily used in conjunction with a computer to solve the problem. (Bell-Cornell) W76-05522

RECORDS AND DRILLING REPORTS. Water Well Journal, Vol. 30, No. 1, p. 30, January

Descriptors: *Documentation. *Data collections. Detailing, *Drillers logs, Logging(Recording), Sub-surface mapping, *Operations, Monitoring. Identifiers: *Water well drilling forms, Well drilling estimates.

Paper work, forms and procedures for any well drilling operation are outlined. Systematic record keeping methods are described and helpful record keeping hints are presented. Procedures for drawing up estimates, contracts, work orders, well logs, billing statements and maps are described. (Heiss-NWWA) W76-05557 WATER MANAGEMENT CONTROL SYSTEM FOR THE ZAGYVA-TARNA RIVER BASIN, National Water Authority, Budapest (Hungary). For primary ibiliographic entry see Field 4A. W76-05746

REAL-TIME MANAGEMENT OF WATER-

RESOURCE SYSTEMS,
Thames Water Authority, Reading (England).
Operational Research Unit.

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D.G. Jamieson.
Working Paper No. 20, UNDP/UN Interregional
Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 3 fig, 13 p, 5 ref. (United Nations, Department of Economic and Social Affairs).

Descriptors: *Water resources development, *Management, *Multiple-purpose reservoirs, *Automatic control, Dynamic programming, Simulation analysis, Optimization, Digital computers, Forecasting, Telemetry, Data collections, Radar, Storage, Water policy, Operations research, River regulation, Hydrology, Mathe-

matical models.
Identifiers: *Real-time management, River Dee(North Wales), Conjunctive operation, Cost

At the design stage, too little attention is paid to the way in which the proposed water resource system is to be managed. Operating rules are usually assumed rather than derived objectively, usually assumed rather than derived objectively, and the only acknowledgement to the inherent management difficulties is the addition of a fixed percentage on all releases to cover 'operating losses.' If the scheme is ever constructed, inevitably the problems associated with operating the system in real-time must be faced. Usually, such a scheme would have to be operated conjunctively with other existing reservoirs, or perhaps the scheme has been promoted with multiple ob-jectives. Whatever the particular circumstances, the competent management of complex water resource systems generates formidable operating difficulties. This report shows how some of these problems were overcome by formulating automated control procedures for a series of multi-pur-pose reservoirs which regulate the River Dee in North Wales. Radar is used in association with other sensors to establish the existing state of the system. The action of the small control computer is to process the telemetered data on-line, forecast the future state of the system and decide the op-timal releases from storage. The forecasting is based on digital simulation and the decision mechanism on dynamic programming. (Bell-Cor-W76-05747

EX-POST EVALUATION OF RIVER BASIN DEVELOPMENTS IN PAKISTAN,

Arizona Univ., Tucson.

S. M. H. Bokhari.

Working Paper No. 22, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 26 p, 1 fig, 2 tab, 17 ref.

Descriptors: *River Projects, basin development. Evaluation, Projects, Alternative planning, Water law, Management, History, Design, Opera-tions, Constraints, Aquifers, Storage, Water quali-ty, Methodology, Economic efficiency, *Post-im-

poundment. Identifiers: *Pakistan, *Developing countries, Cost-effectiveness approach, Tubewells.

River basin developments in Pakistan during the last 125 years have progressively produced a unique water system: the biggest integrated single network of dams, diversion weirs, interbasin links, and irrigation canals. But inadequate drainage and primitive farm management have made fertile ir-rigated lands saline and waterlogged. A multiob-jective Reclamation Program aiming at eradication of waterlogging and salinity, reclamation of al-ready affected lands and augmentation of water availability throughout the irrigated areas was launched in 1959-60. The program included 26 tu-bewells and drainage projects. SCARP I was the first project to be completed in 1963. The ex-post evaluation of this project using the cost-effective-ness approach is presented. It is verified that most of the objectives of the Public Reclamation Proor the objectives of the Public Reclamation Pro-gram could be achieved more efficiently and at a much less cost by encouraging farmers to install their own tubewells. It has been observed that some assumptions made by the planners were not so close to the real life. Planning and design criteria did not match the local conditions, causing shortfalls in the planned targets. New guidelines are being evolved for drawing up a comprehensive Master Plan for the entire irrigated areas. Pakistan's self-sufficiency will depend on the timely completion and optimum management of this program, which is equally important for the overall economic development as agriculture is the mainstay of Pakistan's economy. (Bell-Cornell) W76-05748

THE CZECHOSLOVAK WATER DEVELOP-MENT PLANNING APPROACH AND ITS AP-PLICATION, Ministry of Forest and Water Management, Prague (Czechoslovakia). M. Jermar, and V. Plecnac.

Working Paper No. 23, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 9 p.

Descriptors: *Water resources development, *Comprehensive planning, Water utilization, Management, Decision making, Economics, Control, Social aspects, Water law, Projects, Research, Water allocation(Policy), Optimum development plans.

Identifiers: *Czechoslovakia. Developing coun-

tries, Objectives.

The final objective of the Czechoslovak complex planning approach is a systematic control of the comprehensive interrelations among water, na-ture, and various society aims. Three stages can be distinguished in the integrated application of the approach to water resources utilization in developing countries: (1) enactment of a modern water law, stabilization and simplification of the struc-ture in the field of water development, and inten-sification of efforts in coordination of surveys and investigation; (2) approval of basic standards and by-laws, and establishment of a water resources planning institute--strengthening the planning de partment of the central water management board; and (3) identification of development priorities based on the middle-term plan, definition of economic goals as they relate to the development and beneficial utilization of water resources, and and beneficial utilization of water resources, and determination of water use projections and the locations and times of their expected utilization. Projecting to the ultimate stage technically imaginable on the basis of realistic development trends and not the economy of one single stage should be the key factor of the decision-making process. (Bell-Cornell) W76-05749

THE COLUMBIA BASIN PROJECT REAP-PRAISED.

Central Washington State Coll., Ellensburg For primary bibliographic entry see Field 4A. W76-05750

EVALUATION OF THE EFFECTS OF WATER TRANSFER, Research Inst. for Water Resources Development,

Budapest (Hungary). M. Domokos.

Working Paper No. 25, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, September 1975, Budapest, Hungary. 30 p, 6 fig. 11 ref.

Descriptors: *Water transfer, *Evaluation, *Effects, Measurement, Projects, Water shortage, Water demand, Water utilization, Optimum development plans, Inter-basin transfer, Systems analysis, Alternative planning, Cost-benefit ratio, Investment, Simulation analysis, Risks. Identifiers: Danube-Tisza Canal(Hungary), Least

The measures aiming at an elimination of water shortages either (1) decrease water demands, or (2) increase utilizable water resources or harmonize the areal and time distribution of these two factors. By water transfer, belonging to the second group of measures, a physical transportation of water between two catchment areas of equal rank is meant. A water transfer is justified (a) if it is the least-cost one of all solutions possible for climinat-ing the given water shortage; (b) if the advantages achieved by it exceed the sum of disadvantages caused by it plus the cost of the diversion; and (c) if it is the most productive among the possible al-If it is the most productive among the possible alternative investments of the national economy. This paper considers also the prospective Danube-Tisza Canal in Hungary. The purposes of the Canal are: (a) water transfer from the Danube into the Tisza River basin; (b) the foundation of economic development within the influence zone of the Canal; (c) a useful complementing of the European waterway-system; (d) land drainage; and (e) recreation potentials. (Bell-Cornell) W76-05751

DECISION MAKING AND PLANNING FOR RIVER BASIN DEVELOPMENT, Arizona Univ., Tucson. Dept. of Systems and In-dustrial Engineering; and Arizona Univ., Tucson. Dept. of Hydrology and Water Resources. L. Duckstein.

Working Paper No. 27, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 28 p. 5

Descriptors: *River basin development, *Decision making, *Alternative planning, Classification, Mathematical models, Equations, Algorithms, Op-timization, Systems analysis, Cost-benefit analy-

timization, systems analysis, Cost-oenerit analysis, Methodology, Evaluation, Hydrology, Economics, Operations research, Risks. Identifiers: Multiple purpose, Multigoal problems, Multiobjectives, Benefit-risk analysis, Bayesian decision theory, Induced safety algorithm, Sentitivity-analysis. sitivity analysis

The functioning of a river basin is first described in terms of a simple system model in order to agree on terminology and set the stage for a classifica-tion of decision and planning problems. In this classification, a distinction is made between single and multiperiod, then multipurpose and multigoal problems. The possible level and phase of development of a river basin is examined and the types of uncertainties that arise in planning are briefly reviewed. Basic tools for analyzing river basin development go from benefit-cost analysis to multiobjective programming and cost-effective-ness analysis (CE) schemes. It appears that the CE ness analysis (CE) schemes. It appears that the CE
methodology provides a simple, yet fairly comprehensive, step-by-step approach to water
sight studies. In this spirit, papers of the seminar
that are relevant to the present topic are reviewed
along the basic steps of CE. Difficulties may
emerge as soon as one of the steps of CE is not
considered starting with the fairly to defice agree. considered, starting with the failure to define carefully economic, social, and environmental objectives. (Bell-Cornell) W76-05752

INTER BASIN TRANSFER OF WATER RESOURCE CASE STUDY OF INDUS PRO-

West Pakistan Water and Power Development Authority, Lahore. For primary bibliographic entry see Field 4A. W76-05753

Field 6-WATER RESOURCES PLANNING

Group 6A-Techniques Of Planning

TECHNICAL-ECONOMIC PLANNING OF THE GABCIKOVO-NAGYMAROS BARRAGE PRO-JECT FOR THE DEVELOPMENT OF THE CEN-

TRAL-DANUBE BASIN, National Water Authority, Budapest (Hungary). For primary bibliographic entry see Field 4A.

SOCIAL IMPACTS OF INTEGRATED RIVER BASIN DEVELOPMENT ON LOCAL POPULA-

California Inst. of Tech., Pasadena. Div. of Humanities and Social Sciences.

Working Paper No. 30, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 22 p, 23 ref. (United Nations, Department of Economic and Social Affairs)

Descriptors: *Social impact, *River basin develop-ment, *Project planning, *Human population, Relocation, Behavior, Attitudes, Stress, Commu-

nication, Dams. Identifiers: *Socio-cultural systems, Developing

While economic impacts are carefully assessed in project planning, and increasing attention is being paid to ecological impacts, social impact statements have yet to gain wide acceptance. A more careful consideration of the effects of river basin development on the socio-cultural systems of local populations would enable decision makers to avoid the costly mistakes of the past which are all too frequently repeated. Local populations can be divided into a) those undergoing relocation as a result of dam construction and subsequent inunda-tion; b) those among whom the relocatees are resettled; c) other river basin residents who are neither relocatees or hosts; and d) immigrants. Systematic research has been carried out among categories a and b, which has important policy implications. Compulsory relocation is characterized by multidimensional stress. In attempting to cope with this stress and to adapt to their new homes and neighbors, the relocatees appear to respond as if a socio-cultural system was a closed system. As for the hosts, resettlement authorities should anticipate future land disputes with the relocatees. Far too little research has been carried out on the impacts of river basin development as such on other river basin residents and on immigrant populations. The best development strategy is to facilitate local initiative by improving communications with river basin residents throughout the period of project planning and implemetation. (Bell-Cornell) W76-05755

INTERNATIONAL MANAGEMENT OF THE

RIVER PLATE BASIN, University of Western Ontario, London. Dept. of Geography. For primary bibliographic entry see Field 4A. W76-05756

SIMULATION AS A TOOL IN INTERNA-TIONAL RIVER DEVELOPMENT,

Karlsrube Univ. (West Germany). Institut fuer Wasserbau III.

Working Paper No. 32, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 28 p, 10 fig, 11 equ, 12 ref. (United Nations, Department of Economic and Social Affairs)

basin develo,
*Water resources,
trais, Mathematical Descriptors: *Simulation *River Descriptors: *River basin development, *Simulation analysis, *Water resources, *Planning, Systems analysis, Mathematical models, Equations, Reservoirs, Floods, Costs, Hydrology, Discharge(Water), Daily, Stochastic processes, Markov processes, Identifiers: Monte Carlo method.

International river basins are, from the point of view of operations research, water resources systems which can be treated just like water resource systems within national boundaries. After the strategies that are possible to the nations concerned have been evaluated, they will result in constraints which the system optimization must satisfy. To allow for the stochastic nature of the hydrological data which form the input to water resources systems, it is recommended to explore whether the problem can be solved by simulation analysis. The method of simulation permits giving confidence limits to the optimal solution, but it may have the disadvantage of requiring large com-puters, particularly if large numbers of parameters have to be varied in order to reach optimal conditions. The methods of simulation, including Monte Carlo modeling, Markov processes, and the Thomas-Fiering model, which have been found useful in the work of the author's Institute are outlined and some typical problems discussed. The importance of the characteristic time in selecting themodel is pointed out, and a new method for generating daily discharges is described. (Bell-Cor-W76-05757

LONG RANGE PLANNING OF WATER RESOURCES: A MULTI OBJECTIVE AP-

PROACH, National Water Authority, Budapest (Hungary). Dept. of Water Management Policy.
D. Laszlo, and L. Duckstein.

Working Paper No. 36, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 41 p, 6 fig, 6 tab, 22 ref. (United Nations, Department of Economic and Social Affairs)

Water resources, *Long-term planning, *River basin development, *Water management(Applied), Alternative planning, Methodology, Algorithms, Probability, Economics, Reservoirs, Canals, Groundwater storage, Systems analysis, Hydrology, Social

Identifiers: *Multiobjective approach, *Tisza River basin(Hungary), *Cost-effectiveness approach, Sensitivity analysis.

This paper compares alternative long-range development schemes of an existing water resources system in Hungary. System goals are to meet increasing economic and social requirements of water management. A comprehensive cost-ef-fectiveness approach has been adapted to define the goals, specifications, criteria, and alternatives and their capabilities. Specifications include de-mands given in probabilistic terms. The energy balance leads to an explicit criterion. Important ractors involving social elements, such as flood protection or land and forest use, are described both as monetary quantities and qualitative ap-preciations. The multi-criterion algorithm ELEC-TRE is then used to rank systems and reduce the problem to the trade off between only two alterna-tives. The methodology is applied to a water resources system in the Hungarian great plain of the Tisza River basin. (Bell-Cornell) W76-05760

FLOOD LOSS MANAGEMENT IN DEVELOP-ING COUNTRIES: A MODEL FOR IDENTIFY-ING APPROPRIATE STRATEGIES. Victoria Univ. (British Columbia). Dept. of Geog-

W. R. D. Sewell, and H. D. Foster.

Working Paper No. 39, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 30 p, 4 fig, 2 tab, 8 ref. (United Nations, Department of Economic and Social Affairs.)

Descriptors: *Flood Descriptors: *Flood control, *Management, *Economics, Flood plains, Risks, Optimum development plans, Mathematical models, *Management, development models. Systems analysis

Identifiers: *Flood loss, *Developing countries, Economic growth, Economic development, International cooperation

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In many developing countries, the magnitude of future potential flood losses is increasing rapidly, particularly as a result of the movement of industries and their associated labor forces onto flood plains. In such areas, they are unprotected by sophisticated engineering works, land use regula-tions, or satisfactory warning and evacuation systems. Heavy flood losses, therefore, commonly occur. Presented is a heuristic model which can be used to relate a country's flood problem to the level of development that is appropriate in adjusting to it. Suggestions are made concerning specific strategies that countries with differing levels of economic development and degrees of risk might adopt to reduce flood hazards. A wide range of potential adjustments is described. These adjustments include flood protection, watershed management, land use regulations, flood warning and emergency evacuation measures, and in-surance. The risk-growth-sophistication matrix presented in this paper also clearly illustrates the value of international cooperation in dealing with the flood problem. Without such assistance, many developing countries may continue to suffer large flood losses which could prevent their economies from generating sufficient capital to allow the mitigation of future damage. It is argued that inter-national aid and technical cooperation may provide the key to solving this dilemma. (Bell-Cornell) W76-05761

MULTIPURPOSE RIVER PROJECT PLANNING THE LOWER MEKONG BASIN: A DECI-SION APPROACH, Economic Commission for Asia and the Pacific,

Bangkok (Thailand).

K. Chaemsaithong.
Working Paper No. 41, UNDP/UN Interregional Seminar on River Basin and Interbasin De ment, Budapest, Hungary, September 1975. 17 p, 1 fig. 2 tab. 16 ref. (United Nations, Department of Economic and Social Affairs)

Descriptors: *River basin development, *Project planning, *Decision making, *Multiple purpose, Methodology, Alternative planning, Hydrology, Simulation analysis, Economic feasibility, Optimum development plans.
Identifiers: *Lower Mekong basin(Thailand),

Cost-effectiveness approach.

The underlying objectives of water resource development involve social, economic, and environmental considerations. In planning, careful analysis of the interrelated social, economic, and environmental effects should be made in the process of examining water resource alternatives for attaining desired objectives. Kazanowski's cost-effectiveness methodology may be effective for providing a guideline for developing a decision making process for analyzing water resource alter-natives. Because studies of social, economic, and environmental characteristics of each alternative are not completed at this point, the material presented does not suggest which particular alter-native scale of development should be selected but only illustrates a framework for the decision making process which might be followed later on. The decision making process presented includes identification of system requirements for attaining the desired objectives of development and determination of project effects generated from each al-ternative. The process of selecting the best alternative involves analysis of the merits of each alternative with respect to the selected decision criteria in subjective order of ranking, and a choice of applying either a fixed-cost or fixed-effectiveness objective. (Bell-Cornell) W76-05762

AN ECONOMIC MODEL OF WATER USE AND WASTE TREATMENT, Houston Univ., Tex.

Evaluation Process—Group 6B

For primary bibliographic entry see Field 5D. W76-05814

DETAILED ECONOMIC MODELS FOR INDUSTRIAL AND OTHER ACTIVITIES. Bari Univ. (Italy).
For primary bibliographic entry see Field 5G.
W76-05817

SOCIAL IMPACT ASSI ANALYTIC BIBLIOGRAPHY, ASSESSMENT: Brown Univ., Providence, R. I. For primary bibliographic entry see Field 6B. W76-05820

SOCIAL SCIENCE DATA BANKS AND THE IN-STITUTE FOR WATER RESOURCES, American Univ., Washington, D.C. For primary bibliographic entry see Field 6B. W76-05822

AN ECONOMIC ANALYSIS OF WATER USE IN COLORADO'S ECONOMY,
Colorado State Univ., Fort Collins. Dept. of

Economics.

For primary bibliographic entry see Field 6B.

MULTI-OBJECTIVE WATER RESOURCES PLANNING: METHODOLOGY TO ACHIEVE COMPATIBILITY BETWEEN ENVIRONMEN TAL AMENITIES AND ECONOMIC DEVELOP-

Clemson Univ., S. C. Dept. of Environmental Systems Engineering. For primary bibliographic entry see Field 6B. W76-05840

APPLICATION OF MULTI-REGIONAL PLANNING MODELS TO THE SCHEDULING OF LARGE-SCALE WASYSTEMS DEVELOPMENT. WATER RESOURCE

Geological Survey, Reston, Va.

D. W. Moody. Journal of Hydrology, Vol 28, No 2/4, p 101-125, February 1976. 3 fig, 2 tab, 14 ref.

Descriptors: *Regional analysis, *Regional economics, *Water resources development, *Model studies, *Project planning, Water demand. Cost analysis, Hydrology, Groundwater, Surface waters, Water yield, Groundwater recharge, Water importing, Aquifer characteristics, Hydraulic structures, *Puerto Rico.
Identifiers: *Mixed-integer programming model.

This paper describes a water resources planning model that is also formulated as a mixed-integer program. A given geographic area is divided into planning regions within which regional water demands are assumed to be located at single points. Water import and export projects interconnect the planning regions. For each planning period, the model determines the water-supply projects to be built and the amount of water to be produced, treated, and imported or exported to meet future water demands at minimum present cost. Model constraints include a response function which relates groundwater withdrawals to aquifer recharge induced from stream segments that form bounda-ries of the aquifer. The use of this model in conjunction with several water demand models, used to evaluate the impact of nonstructural measures, are also discussed in the context of water resources planning in the Commonwealth of Puerto Rico. (Woodard-USGS)

SOCIAL ASSESSMENT MANUAL: A GUIDE TO THE PREPARATION OF THE SOCIAL WELL BEING ACCOUNT,

Abt Associates, Inc., Cambridge, Mass.

For primary bibliographic entry see Field 6B. W76-05993

A PORTFOLIO APPROACH TO PUBLIC WATER PROJECT DECISION MAKING, Wesleyan Coll., Macon, Ga. Dept. of Business Administration. For primary bibliographic entry see Field 6B.

6B. Evaluation Process

W76-05995

SOCIOLOGICAL ANALYSIS OF DAM IMPACT: A STUDY OF TWENTY-TWO LARGE DAMS IN

TEXAS,
Texas A and M Univ., College Station. Dept. of
Sociology and Anthropology.
R. C. Schaffer.
In: 'Reservoir Impact Study,' p. 2.i-2.159,

November 1974, 45 tab, 7 ref, 1 append.

post-evaluation, Descriptors: *Project Reservoirs, *Social impact, *Economic impact, *Attitudes, Surveys, *Texas, Benefits, Flood control, Recreation, Land use, Management, Urbanization, Institutions.

Identifiers: *Reservoir impact, *Canyon Reservoir(Tex), Guadalupe River(Tex), Land acquisi-

The initial attitudes of community leaders and organizations toward construction of 22 reservoirs in Texas during the periods of 1944-48, 1951-54, and 1963-68 were surveyed and their perception of the impact of the reservoirs were evaluated from the perspective of time, with primary focus on Canyon Lake on the Guadalupe River, Texas. Over 75% of the leaders had favored dam construction originally; of those opposed, approximately 20% were later convinced of the value of the dam to their community. Most of the local or-ganizational support came from Chambers of Commerce while opposition stemmed from af-fected land owners. Respondents indicated that the dams had resulted in major economic gains in terms of increased land values, water-related com-merce, building, and bank deposits and loans; and that landowners and investors in each area and businesses were the principal economic beneficiaries. More than 90% emphasized the importance of the enhanced recreational opportunities, while more than 20% were impressed with the number of local families who used the facilities frequently. They agreed that flood protection was enhanced; and over 70% felt that construction had assured an adequate water supply. Most felt that the federal government should have considerable responsibility for planning, construction, and operation of a dam. There was general satisfaction, except for the land acquisition process, with the efforts of the Corps of Engineers in all three areas. (See also W76-04501) (Auen-Wisconsin). W76-05501

COPING WITH FLOOD HAZARD IN NEW BRAUNFELS AND SEGUIN, TEXAS, Southern Illinois Univ., Carbondale. Dept. of

Geography.
For primary bibliographic entry see Field 6F. W76-05502

SOME ECONOMIC AND DECISION ASPECTS OF THE CANYON PROJECT,

Texas A and M Univ., College Station. Dept. of Geography; and Texas A and M Univ., College Station. Dept. of Geology.

In: 'Reservoir Impact Study,' p. 6.i-6.54, November 1974. 8 fig, 10 tab, 14 ref.

Descriptors: *Reservoirs, *Project post-evalua-tion, *Benefits, *Decision making, River basin development, Economic impact, Environmental

effects, Public benefits, Social impact, Planning, Direct benefits, Indirect benefits, Discount rates, Costs, Flood control, Economic efficiency, Costbenefit ratio, Texas, Estimating, Property Recreation. Identifiers: *Canyon Dam(Texas), Guadalupe

River(Texas)

The anticipated benefits and projected costs in the planning stages of the Texas' Canyon Dam and Reservoir on the Guadalupe River are detailed and discussed. The anticipated regional economic development, benefits from navigation, generation of electricity, conservation storage, and flood control were either totally unrealized or partially realized. On the basis of national economic efficiency Canyon Dam now exceeds unity only if recreation benefits are included in the calculation; the project is justified by a very narrow margin at the 5.625% discount rate. The water-conservation benefits appear to be considerably lower than projected in the 1959 benefit-cost analysis. The recreation benefit has greatly exceeded forecasts and is higher than the flood-loss and water-conservation benefits. Analysis of the planning process indicated in-adequate public participation, lack of consideration of alternatives, and that little attention was given to secondary benefits and almost none to secondary costs. Comparison of the planning process with the proposed similar dam at Clopton Crossing, indicated little change in the basic decision process. Most of the primary beneficiaries still were not called upon to bear any user or repayment charges, no local public hearing was held until after Congressional project authorization; there remained a complete lack of any role in the decision process for disinterested analysis. Recommendations are made for changes in the decision processes based on identified value judgments. (See also W76-04501) (Auen-Wiscon-W76-05505

AN EVALUATION OF SOME RECREATIONAL, DEMOGRAPHIC AND ECONOMIC IMPACTS OF CANYON LAKE,

Texas Agricultural Experiment Station, College Station. Dept. of Recreation and Parks.

J. C. Stribling, C. Burchell, F. Clark, R. Miller, and

M. Seminara. In: 'Reservoir Impact Study,' p. 7.i-7.38, November 1974. 8 fig, 8 tab, 9 ref.

Descriptors: *Reservoirs, *Economic impact, *Social impact, *Recreation, *Human population, Project post-evaluation, Texas, Social aspects, Agriculture, Urbanization, Transportation, Public utilities, Flood plains, Land use. Identifiers: *Reservoir impact, *Canyon Lake(Texas), Guadalupe River(Texas), Com-

The impact of Canyon Reservoir on population growth, settlement, and characteristics, housing and urbanization, transportation, utilities, communications, wholesale and retail trade, recreation, and agriculture in the primary impact area and the seven-county area centered on Comal County, Texas, are compared with what would have occurred had the reservoir not been built. The existence of approximately 100 houses, cottages, and cabins on the floodplain can be attributed to the dam. The potential number of canoe rentals, picnic and camp grounds enterprises was diminished by one-half since that portion of the Guadalupe River inundated was similar to that immediately below the dam. Rainbow trout fishing would not be possithe dam. Kainoow frout insing would not ee possible without the reservoir. Approximately 12,000 inundated acres would have been available for agriculture. The most pronounced difference in land use attributable to the reservoir is the subdivision development in the vicinity of the lake, where the population has increased by almost 2000. The new permanent residents are of a higher median age, have higher incomes, and outnumber the older residents. Seven public recreation areas have been added. Highway construction and main-

Field 6-WATER RESOURCES PLANNING

Group 6B-Evaluation Process

tenance is higher. The most notable effect is the rise in land values near the reservoir thus increasing property tax revenues. The economic and demographic impacts diminish rapidly away from Canyon Lake. (See also W76-04501) (Auenconsin). W76-05506

UNCERTAINTY IN DECISION MAKING, IN WATER RESOURCES

Water Resources Center, Budapest (Hungary). For primary bibliographic entry see Field 6A. W76-05513

A REVIEW OF SOME HYDROLOGICAL STU-DIES REQUIRED IN THE DESIGN OF WATER MANAGEMENT PROJECTS.

Meteorological Organization, Geneva (Switzerland). For primary bibliographic entry see Field 4A.

W76-05517

W76-05521

GOALS AND FORMS OF CO-OPERATION AMONG COUNTRIES FOR THE DEVELOPMENT OF INTERNATIONAL RIVER BASINS, Research Inst. for Water Resources Development, Budapest (Hungary). For primary bibliographic entry see Field 4A.

PLAN FORMULATION AND EVALUATION STUDIES--RECREATION, VOL. II OF V. ESTI-MATING INITIAL RESERVOIR RECREATION USE,

Army Engineer District, Sacramento, Calif. R. E. Brown, D. M. Crane, C. R. DesJardins, and R. Hydra.

Army Engineer Institute for Water Resources Fort Belvoir, Virginia, IWR Research Report 74-R1, June 1974. 393 p. 117 fig., 40 tab.

Descriptors: *Estimating, *Recreation, *Reservoirs, *Methodology, Use rates, Recreation demand, Surveys, Forecasting, Statistics, Data collections, Facilities.

Methodology for estimating initial recreation use at prospective Corps of Engineer reservoirs, based on the 'most similar project' concept, is described. Recreation-use data were collected from surveys of recreationists at 52 reservoirs of various sizes and characteristics from different areas of the United States. About 238,000 sampling units (vehicles) comprising about 735,000 individuals were surveyed, reflecting a diversity of regional conditions and population characteristics. The data were representative of almost all recreationists visiting a particular reservoir. Standard statistical measures were used to determine reliability of collected statistics in estimating recreation use. Pertinent data, such as per capita use rates and recreation-use data summaries, are given for each reservoir. Based on these data, methodology was developed for estimating recreation attendance at proposed projects. Detailed discussion and evaluations of prospective reservoir projects and criteria for selecting similar projects are included. Although much of the guess-work for estimating recreation use and benefits for reservoir projects is eliminated, it is not the final solution as there are inherent deficiencies. The technique will be reviewed and improved as more recreation-use data are collected. (See also W75-10342 thru W75-10345) (Buchanan-Davidson--Wisconsin). W76-05611

HOW TO GUIDE GROWTH IN SOUTHEAST-ERN NEW ENGLAND, PARTS I, II AND IV OF THE DRAFT REPORT.

New England River Basins Commission, Boston, Mass. Southeastern New England Study. For primary bibliographic entry see Field 6G. W76-05649

PERSPECTIVE 75.

East Central Florida Regional Planning Council, Winter Park 1974. 50 p, 17 tables.

Descriptors: *Floods, Evaluation, *Community development, *Economic impact, *Aquifers, *Land use, *Water quality, *Sewage treatment, *Water supply, Population, Construction, *Water supply, Populati Recharge, Marshes, *Florida. Recharge, Marsnes, Florida. Identifiers: Brevard County(FL), Indian River County(FL), Lake County(FL), Orange County(FL), Seminole County(FL), Orlando(FL), East

Central Florida, Retired persons, Tourists, National economy, Lake Washington(FL), Osceola County(FL).

Using selected time series data (population indices, employment, social security beneficiaries, retail sales, non-agricultural employees), this nontechnical short term economic overview of the East Central Florida Region explores the present economic state of each county and analyses the issues and ramifications of gaining more development. Lake and Indian River counties, the counties most dependent on agriculture, suffered a slowing of economic activity in 1974. Yet population continued to increase in both counties mainly as the result of retiree in-migration demanding new residences and services. A gradual economic recovery is expected in 1975. The Oklawaha River Basin Plan to improve sewage treatment is progressing. Lake County must prepare controls for development of the recharge area for the Floridan aquifer which supplies water for much of central Florida. Brevard County, still adjusting to the reduction in employment at Kennedy Space Center with the commensurate decline in demand for goods and services, attempted to recruit new employers in other fields. Increased retail sales were attributed to the influx of retirees. Tourism is becoming increasingly vital to the economy. Bonds are being used to upgrade, extend, and integrate the Brevard sewage treatment facilities. Concern over water supply is complicated by reliance on increasingly polluted Lake Washing-ton. Orange, Seminole, and Osceola Counties, comprising the Orlando Metropolitan Area, are also recruiting employers with prospects for economic diversification boosted by the current surplus of labor and facilities. East Orlando and Orange County are waiting for construction of a sewage treatment plant to relieve the present over-burdened plant. (Henley - North Carolina) W76-05651

STRUCTURING COMMUNICATIONS PRO-GRAMS FOR PUBLIC PARTICIPATION IN WATER RESOURCES PLANNING, Utah State Univ., Logan. Dept. of Civil and En-

vironmental Engineering.

A. B. Bishop. Available from the National Technical Information Service, Springfield, Va 22161 as AD-A012 tion Service, Springited, va 22161 as AD-A012 280, \$6.00 in paper copy, \$2.25 in microfiche. DACW73-72-C-0069. Prepared for US Army En-gineer Institute for Water Resources, Fort Belvoir, VA, May 1975. 125 p, 22 fig, 3 tab, 27 ref.

Descriptors: Water resources, *Project planning, *Project feasibility, *Communication, *Planning, Water quality, *Federal Water Pollution Control Act, Social aspects, Legislation, Costs, Benefits,

Identifiers: *Public participation, *Environmental impact assessment, *Water quality management, River basin planning, Level B planning of river basins.

Though recent Federal legislation requires public involvement in the planning processes, and efforts have been made to implement this legislation. much more can be done to involve citizens in planning for water and related land-use programs. Planning is viewed as a series of steps consisting of problem definition, formulation of alternatives, impact analysis, and evaluation. Public participa-

tion must be actively sought. There are 2 objectives of participation from an agency's point of view: to inform and to get reaction to proposals. These can be met by 4 tasks: identify problems and needs; generate ideas and solve problems; review planning data and analysis; and provide values and preferences for decisions. Each task can and should be actively participated in by citizens. Identification of publics is an important element. Conceptually, publics can be classed into those affected by the problem (adversely and beneficially), those affected by the solution, and those not affected, but particular groups must be sought out. This can be done by self-identification, third party identification, and staff identification. After affected groups have been identified com-munications is very important. Many techniques are possible depending on size and other characteristics of groups involved, and the information to be communicated from the agency to the public or vice versa. Possibilities for reaching a cross-section of publics are discussed. A compact summary of various media techniques is given. Several examples are given in some detail of public participation sequences which are possible under legislation involving the Corps of Engineers. (Smith -North Carolina) W76-05652

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CRITERIA FOR EVALUATION OF SOCIAL IM-PACTS OF FLOOD MANAGEMENT ALTERNA-

Institute of Public Administration, New York, R. Mack

Available from the National Technical Information Service, Springfield, Va 22161 as PB-238 496, \$6.00 in paper copy, \$2.25 in microfiche. CRSS-NERBC 1.6G, NERBC 1.6B. Prepared for New England River Basins Commission, Boston. Working papers, 1974 146 p, 2 tab, 2 append, 1 plate.

Descriptors: *Cost-benefit *Management, *Floods, *Flood protection, Water resources planning, *Social impacts, Benefits, Costs, *Connecticut River, Vermont, Massachusetts, Evaluation.

Identifiers: Westfield(MA), North Springfield Reservoir(VT), Utility theory, Flood plain management, Connecticut River Basin, Westfield River(MA), Black River(VT), Brattleboro(VT).

Social impacts, i.e. impacts that are broadly personal and relate largely to social well-being, of floods and flood protection alternatives are not easily put into a common framework like dollars, and a poor person values an extra dollar of income differently than a rich person. Thus a normal benefit/cost framework is difficult to employ. Political processes which should take these intangibles into account are unable to deal with the complexity and subtlety of an integrated multimeans, multi-purpose flood management program. Normal statistics provide little information on social impacts so case studies of extreme situations are used including the North Springfield Dam Project in Black River, Vt. and the Westfield, Ma. flood of 1955. The study proceeds in two steps: (1) On-site detailed chronicles of what happened during selected episodes are garnered from newspapers, interviews and inspection, focusing on desirable and undesirable impacts on reople (2) A system which emulates the benefit/cost analysis is used to tally costs and benefits out this system goes behind dollar measures to the basic utilities. A taxonomy of 9 utility categories was set in an explorative model (e-model) of consumer behavior addressed at optimizing total well-being as envisaged by the household. Findings point out differences in impacts on different groups of people over different periods of time. Attention to social impacts emphasizes the possibility of designing alternatives to improve results with social impact being considered early in the design phase. (Smith - North Carolina) W76-05653 A STUDY OF PROSPECTIVE WATER POLLU-TION CONTROL ACTIVITIES FOR THE OHIO RIVER VALLEY WATER SANITATION COM-MISSION (ORSANCO), Wendell Associates, McLean, Va.

For primary bibliographic entry see Field 5G. W76-05654

EFFICIENCY IN WATER QUALITY CONTROL FOR THE WILLAMETTE RIVER, Oregon Univ., Eugene. Dept. of Economics. For primary bibliographic entry see Field 5G. W76-05658

MANAGEMENT OF ENVIRONMENTAL QUALITY: OBSERVATIONS ON RECENT EXPERIENCE IN THE UNITED STATES AND THE UNITED KINGDOM, North Carolina Univ., Chapel Hill. Dept. of City

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and Regional Planning.
For primary bibliographic entry see Field 5G. W76-05659

PROPOSAL FOR A TRANS-MEDITERRANEAN AQUEDUCT,

Ottawa Univ. (Ontario). For primary bibliographic entry see Field 4A. W76-05660

URBAN WATER MANAGEMENT OF AN INTERNATIONAL RIVER: THE CASE OF EL PASO -JUAREZ. University of Western Ontario, London. Dept. of

For primary bibliographic entry see Field 3D. W76-05661

DECISION MAKING AND PLANNING FOR RIVER BASIN DEVELOPMENT, Arizona Univ., Tucson. Dept. of Systems and In-

dustrial Engineering; and Arizona Univ., Tucson. Dept. of Hydrology and Water Resources. For primary bibliographic entry see Field 6A W76-05752

SOCIAL IMPACTS OF INTEGRATED RIVER BASIN DEVELOPMENT ON LOCAL POPULA-

California Inst. of Tech., Pasadena. Div. of Humanities and Social Sciences.

For primary bibliographic entry see Field 6A. W76-05755

LONG RANGE PLANNING OF WATER RESOURCES: A MULTI OBJECTIVE AP-

PROACH, National Water Authority, Budapest (Hungary). Dept. of Water Management Policy. For primary bibliographic entry see Field 6A. W76-05760

MULTIPURPOSE RIVER PROJECT PLANNING IN THE LOWER MEKONG BASIN: A DECI-SION APPROACH,

Economic Commission for Asia and the Pacific, Bangkok (Thailand) For primary bibliographic entry see Field 6A.

W76-05762

THE MASTER PLAN FOR WATER SUPPLY IN THE REGIONAL MUNICIPALITY OF OTTAWA-CARLETON,

Ottawa-Carleton Regional Municipality (Ontario). For primary bibliographic entry see Field 6D.

EVALUATION OF QUALITY PARAMETERS IN WATER RESOURCE PLANNING: A STATE-OF-

THE-ART SURVEY OF THE ECONOMICS OF W76-05822 WATER QUALITY, Bovet (Eric D.) Alexandria, Va.

For primary bibliographic entry see Field 5G. W76-05818

SOCIAL IMPACT ASSESSMENT: ANALYTIC BIBLIOGRAPHY, Brown Univ., Providence, R. I.

M. A. Shields. Army Engineer Institute for Water Resources IWR paper 74-P6, October 1974. 134 p. 40 ref., 3

Descriptors: *Water resources development, *Social impact, *Measurement, *Bibliographies, Social aspects, Analysis, Methodology, Welfare(Economics), Economic impact. Identifiers: Social impact assessment.

An attempt is made to provide solutions to the problems of analyzing the social impact of water development projects as they relate to demographic impacts, institutional impacts, displacement and relocation, economic impacts (income, employment, taxes), community cohesion, lifestyles, legal dimensions, and differential impacts. A bibliography of material related to these areas of social impact analysis relevant to research, evaluation, and methodology containing 22 references is presented in the following format: Title, author(s), place of publication and other identifying information, locators (the specific geo-graphical area), abstract, and findings which highlight the reviewer's particular interest followed by his comments. Eighteen other references are cited bearing on the subject area of social impact assessment. A tabular presentation of methodological approaches to social impact as-sessment is included in the introductory section. (Auen-Wisconsin). W76-05820

SOCIAL SCIENCE DATA BANKS AND THE IN-STITUTE FOR WATER RESOURCES, American Univ., Washington, D.C. A. B. Motz.

Army Engineer Institute for Water Resources IWR Pamphlet No. 1, July 1974, 48 p. 3 fig., 20 ref., 2 append DACW73-74-C-0027.

Descriptors: *Data storage and retrieval, *Social needs, *Social aspects, Water resources development, Decision making, Comprehensive planning, Information retrieval. Identifiers: Quality of life, Social indicators.

Presented is an introduction to and description of the scope and value of social science data banks to sociologists, planners, decision makers, and academicians in determining the effect of water resource development on the quality of life, social attitudes, and social values. The data generally contained in social science data banks are (a) standardized enumerations and sample survey data, (b) service-generated data, and (c) professional and nonprofessional reports. The potential of these data banks is discussed in detail--as to how they assist in raising questions, acquire bibliogra-phies, and select methods in which the sociologist can use the data. Usages of data banks can test hypotheses, content analysis, comparative analyses of trends, longitudinal studies, panel studies, cross-cultural studies, contextual analysis, packaged computer programs, simulations, and to generate theories. It is stressed that these data banks must be considered as one of several resources which may be useful in developing prototypes of sample 'aquasystems' (i.e. ecology) in an effort to ascertain their quality of life. The information can provide researchers and planners with quality of life indicators for a specific water-related ecology. They can also serve as a vehicle for the invasion of individual privacy. The appendix identifies several important data banks availa-ble to social science researchers. (Auen-Wisconsin)

BENEFIT AND COST ANALYSIS OF HYDROLOGICAL FORECASTS. World Meteorological Organization, Geneva (Switzerland).

H. J. Day.
WMO No. 341 (Operational Hydrology Report No. 3), 1973. 41 p. 12 fig. 3 tab, 14 ref, 1 append.

Descriptors: *Cost-benefit analysis, *Flood forecasting, *Warning systems, *Flood damage, Flood protection, Mathematical models, Floodproofing, Cities, River forecasting, Flood peak, Flood waves, High flow. Identifiers: Evacuation, Flood warning time.

An evaluation of the benefits and costs of flood forecasting with regard to flood damage reduction specifically considers the length of warning time, the magnitude of reducible damage, and efficiency of response to a warning. The analytical procedure is based on (1) the economic consequences without any forecasting service; (2) evaluation of the economic consequences when a forecast service is provided; and (3) evaluation of the benefits vs. costs of a forecasting service. A simulation of the Susquehanna River Basin indicated that upon receipt of a warning, benefits will exceed costs. The annual cost of the warning service is based on \$100,000, of which approximately one-third, would be associated with residences. Approximately one-fifth to one-third of urban residential flood damage may be reduced by a warning system (when coupled with 100% response). The estimated costs for evacuation and reoccupation vary widely according to the river segment and type of response to the warning. Temporary flood-proofing costs consistently exceeded those of maximum practical evacuation, and limited warning time. Benefit-to-cost ratios varied from 1.0 to 7.5. The results do not include benefits accruing from industrial and commercial damage reductions result-ing from a warning system and costs associated with the warning service. (Auen-Wisconsin) W76-05823

A TECHNIQUE FOR ENVIRONMENTAL DECI-SION MAKING USING QUANTIFIED SOCIAL AND AESTHETIC VALUES,

Battelle-Pacific Northwest Labs., Richland, Wash.

For primary bibliographic entry see Field 5G. W76-05825

UTAH'S THIRD YEAR OF PLANNING FOR THE FOUR CORNERS REGIONAL COMMIS-

Utah Planning Commission, Salt Lake City. Completion Report, September 1971. 49 p.

*Comprehensive Descriptors: planning, *Methodology, *Regional development, Alternarive planning, Decision making, Utah, Project planning, Evaluation, Data collections, Mapping, Sites, Arizona, Colorado, New Mexico, Professional personnel, Economic impact, Social aspects, Political aspects, Investment, State governments, Regional analysis, Project benefits, Recreation, Agriculture.

Identifiers: Sevier River Basin(Utah), Utah process, Composite mapping, Comprehensive criterion

Development by the Four Corners Regional Commission (representing Utah, Arizona, Colorado, and New Mexico) of the 'Comprehensive Criterion' and computer 'Composite Mapping' as planning tools and their efficacy for project evaluation are discussed and demonstrated. The Comprehensive Criterion' is designed to define project 'returns' from investment, as related to the effect on the area, and by how much; how it will affect specific income groups, and by how much; the extent of employment opportunities, and by

Field 6-WATER RESOURCES PLANNING

Group 6B—Evaluation Process

how much; and the project impact on social and physical environments. 'Composite Mapping' is based on data factors, which is to be enhanced by proximity mapping to define and code areas within any distance of any feature, characteristic of interest, etc., and among its several applications, can be used to define the optimal location of an industry. The Utah State Planning Commission has now begun to integrate administrative agency planning such that each agency will be aware of its on the whole State government. This in tegrated and coordinated planning is designated as the 'Utah Process' and is intended to be used in conjunction with a regional economic model. The results of applying the Comprehensive Criterion to the proposed water and related land resource development project in the Sevier River Basin are demonstrated. (Auen-Wisconsin).

ENVIRONMENTAL IMPACT ASSESSMENT AS AN INSTRUMENT OF PUBLIC POLICY FOR CONTROLLING ECONOMIC GROWTH, Waterloo Univ. (Ontario). Dept. of Man-Environ-

ment Studies For primary bibliographic entry see Field 6G.

W76-05828

COMPARATIVE RISK-COST-BENEFIT STUDY OF ALTERNATIVE SOURCES OF ELECTRI-CAL ENERGY,

Atomic Energy Commission, Washington, D. C.

S. T. Brewer.

Report WASH-1224, December 1974, 250 p. 22 fig., 56 tab., 113 ref.

Descriptors: *Electric power production, *Hazards, *Costs, *Environmental effects, *Public health, Cost comparisons, Electric power-Pollutants, Coals, Oil, Natural gas, Nuclear reactors, Fossil fuels, Efficiencies, Air pollution, Hydroelectric plants, Transportation,

Mining. Identifiers: *Alternate fuel systems.

The societal costs of alternate electrical energy production systems are quantitatively compared, based on a common unit of kilowatt-hours and expressed in dollars, to provide ancillary comparisons and cost-benefit tradeoffs. The entire fuel cycles and their residuals are considered. The systems evaluated are those based on coal, residual fuel oil, natural gas, nuclear fission (LWR) fuels, and hydroenergy. The study is restricted largely to quantification of environmental and human impacts of energy production under normal operating conditions, but certain classes of routine industrial accidents are also treated. 'Costs' include both 'internal' (those already borne by electricity consumers) and 'external' (the environmental and human impacts not accounted for in the price of electricity). The study quantifies effects throughout the respective fuel cycles, from fuel extraction to power generation. The indica-tions are that costs associated with human health and injury, both occupational and public, are less than 1% of the consumers' cost of electricity. External costs, including health, injury, and environ-mental impacts are less than 3%. These estimates, however, exclude effects of fossil fuel airborne pollutants. The ultimate fuel resource availability is apt to have a greater influence in making choices among energy systems than environmental considerations. The various fuel cycles are described in detail, and their efficiencies and pollution abatement costs compared. (Auen-Wisconsin)

AN ECONOMIC ANALYSIS OF WATER USE IN COLORADO'S ECONOMY.

Colorado State Univ., Fort Collins. Dept. of Economics.

S. L. Gray, and J. R. McKean.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 374,

\$6.00 in paper copy, \$2.25 in microfiche. Colorado Environmental Resources Center, Fort Collins, Completion Report Series No. 70, December 1975. 113 p, 31 tab, 8 ref, append. OWRT B-059-COLO(2). 14-31-0001-3265.

*Input-output analysis, requirements, Projections, *Optimization, *Colorado, Economics, Industrial water, *Water utilization, Model studies, *Consumptive use, *Estimating, *Income, *Employment, *Water demand. Constraints.

Water use in the Colorado economy is analyzed using an input-output model constructed for this purpose. A detailed description of the Colorado economy showing sales and purchases among 28 processing sectors and 32 total sectors is derived from personal interview, mail questionnaire and secondary data sources. In addition to the basic input-output flows, sector-by-sector estimates of consumptive water use, employment, and value of output are estimated. A further description of the Colorado economy is provided through estimates of multiplier effects on business activity, income, employment and water use. The major purpose is to relate levels of water use, employment and income within the Colorado economy. The use of the input-output framework to analyze alternative scenarios for growth and resource development in Colorado is demonstrated. Condtional forecasts of alternative futures are presented to demonstrate the use of the input-output technique as a tool for policy formulation. A final extension of the model is the conversion to a simplified optimization model incorporating an objective function of maximizing sales to final demads given a restraint placed upon available water supplies for consumptive use. Given annual growth rates for final demand, the linear programming model indicates how far the economy can expand given current technology and the constraint of 6.6 million acrefeet consumptive water use. As growth takes place a change in product mix and increased imputed water values are observed.

MULTI-OBJECTIVE WATER RESOURCES PLANNING: METHODOLOGY TO ACHIEVE COMPATIBILITY BETWEEN ENVIRONMEN-TAL AMENITIES AND ECONOMIC DEVELOP-MENT.

Clemson Univ., S. C. Dept. of Environmental

Systems Engineering.
D. W. York, B. C. Dysart, III, and L. W. Gahan.
Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 377, \$7.75 in paper copy, \$2.25 in microfiche. South Carolina Water Resources Research Institute, Clemson, Report No. 55, May 1975. 212 p. 25 fig, 76 tab, 192 ref, 6 append. S-037-SC, S-048-SC.

*Planning, *Competing uses, Mathematical models, Water management(Applied), Recreation, Optimization, Intangible benefits, Model studies, *South Intangible Carolina

Identifiers: *Multiple objectives, *Economic development, Great Santee Swamp(SC).

A mathematical model of multiple-use in natural areas was developed. The model represents a unified system for the evaluation of cases where traditional forms of economic development such as industrial manufacturing, suburban residential expansion, or mineral extraction are proposed for relatively natural areas having significant environmental amenity values. The model system is a unique benefit-cost analysis that allows for a rational comparison of the costs and benefits associated with both developmental and environment-related activities. The option value has been incorporated into the analysis, and methods have been devised for the estimation of desirability. Desirability serves as the vehicle for the incorporation of amenity-related values into the analysis. Procedures have also been developed for the

estimation of the degree of compatibility to impose constraints on the system limiting the levels of utilization of relatively incompatible activities. An elementary form of the gradient optimization algorithm was included to facilitate the search for the most promising management schemes. The model was applied to a study of multiple-use management of the Great Santee Swamp in South Carolina. W76-05840

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INSTITUTIONAL CONSTRAINTS AND CON-JUNCTIVE MANAGEMENT RESOURCES IN WEST TEXAS, OF WATER

Texas Tech Univ., Lubbock, Dept. of Geography. For primary bibliographic entry see Field 6E. W76-05842

SOCIAL ASSESSMENT MANUAL: A GUIDE TO THE PREPARATION OF THE SOCIAL WELL BEING ACCOUNT,

Abt Associates, Inc., Cambridge, Mass. S. J. Fitzsimmons, L. I. Stuart, and P. C. Wolff. Prepared for Bureau of Reclamation, Engineering and Research Center, Denver Federal Center, Denver, Colorado, July 1975. 279 p, 19 fig, 3 tab, 16 ref. Bur Reclam 14-06-D-7342 (5)

Descriptors: *Planning, *Evaluation, *Behavior, Data aggregation, Data synthesis, Demography, Human population, Indirect benefits, Long term planning, Optimum development plans, Planning, Political aspects, Public benefits, Social aspects, Social change, Social impact, Social mobility, Social needs, Social participation, Social values, Water policy

Procedures are presented for conducting research and analyzing data to forecas' probable future impacts of implementing alternative water development plans (or no plan) and assessing their beneficial and adverse social effects upon people and their communities. The procedure produces a Social Well-Being (SWB) Account. The Manual is designed to meet the requirements of the U.S. Water Resources Council's Principles and Standards, which mandate a four-account system to assess water development plans in terms of their Social Well-Being, National Economic Development, Regional Development, and Environmental Quality Effects. The SWB Account is built upon the orientation, theory, research, and methodolo gy of sociology and social psychology, systems analysis, multiple objectives planning, and forecasting. The SWB Account is organized into five components, each containing various evalua-tion categories with specified data: Individual, Personal Effects (Life, Protection, and Safety, Health, Family and Individual Attitudes, and Environment); Community, Institutional Effects (Demographic, Education, Government Opera-Law and Justice, Social Service, Religion, Culture, Recreation, Informal Organizations, and Institutional Viability); Area, Social-Economic Effects (Employment and Income, Welfare and Financial Compensation, Communications, Transportation Economic Base, Planning and Construction); National, Emergency Preparedness Effects (Water Supply, Food Production, Power Supply, (Water Supply, Food Production, Power Supply, Water Transportation, Scarce Fuels, Population Dispersion, Industrial Dispersion, Military, and International Treaties); and Aggregate, Social Effects (Quality of Life, Relative Social Position, and Social Well-Being). Completion of the SWB Account requires five steps: Description of the history of water resources of the area, and of the functions, activities, impact area, and schedule of alternative water plans; Description of the planning area to be affected in terms of its history, present-day social profile, and life-style; Identifi-cation of the future social impacts attributable to each alternative plan for each of the components and their evaluation categories; Comparison of the future beneficial and adverse social effects of the alternative plans; and, recommendations of the

plan with optimal future social well-being effects plan with optimal ruture social well-being effects on the plan area. Ultimately, the optimal water development decision will be a function of the combined social, economic, regional, environmen-tal, and regional effects. (Bur Relam) W76-05993

A PORTFOLIO APPROACH TO PUBLIC WATER PROJECT DECISION MAKING, Wesleyan Coll., Macon, Ga. Dept. of Business Ad-

ministration.
W. P. Neely, and R. M. North.

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Water Resources Research, Vol. 12, No. 1, p 1-5, February 1976, 6 tab. 12 ref. OWRT A-040-GA (4).

Descriptors: *Water resources, *Projects, *Cost-benefit ratio, *Economic feasibility, Decision making, Planning, Linear programming, Tennes-see Valley Authority, Constraints, Budgeting, Systems analysis, Mathematical models. Identifiers: *Benefit maximization, *Portfolio ap-

proach, Integer programming.

Federal water resources projects are presently selected on the basis of the benefit-cost ratio (BCR), which is an indicator of the economic feasibility of individual projects. From this initial feasibility test, one may rank all workable projects by descending BCR to produce a portfolio of feasible projects which maximizes the BCR within a constrained budget. The portfolio approach proposed herein is superior to other approaches for project selection, especially when it is comfor project selection, especially when it is comfor project selection, especially when it is com-bined with an evaluation system to maximize net present value (NPV). Linear and integer pro-gramming techniques are combined with empirical data on Tennessee Valley Authority water resources projects to illustrate the superiority and usefulness of the approach in project selection for implementation. The portfolio approach max-mizes NPV and simplifies the application of budget-planning procedures in choosing projects when budget levels are variable or otherwise un-certain. (Bell-Cornell) certain. (Bell-Cornell) W76-05995

EVALUATION OF ECONOMIC BENEFITS FOR FLOOD CONTROL AND WATER RESOURCE PLANNING.

Corps of Engineers, Washington, D.C. For primary bibliographic entry see Field 4A. W76-06083

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COSTS AS A GUIDE TO PRICING,

Sydney Univ. (Australia). Dept. of Accounting. P. Brown.

Journal of the National Water Well Association of Australia, Vol. 4, No. 3, p. 5-7, September, 1975, 1

Descriptors: *Construction costs, *Pricing, *Income, *Risks, Income analysis, Cost-benefit analysis, Cost-benefit theory, Cost-benefit ratio, Descriminatory pricing, Direct benefits, Direct costs, Incremental income, Real income, In-

If an element of cost or revenue is unaffected by a particular decision, the, the element can safely be ignored. 'Cost' means 'sacrifice'. Cost refers to fu-ture action, not a past action. Some examples: (a) owners salary, were the driller not self-employed in an unincorporated business by other members of the family, use of family car, office in the home, and the telephone, (b) down-the-hole equip ment. Revenue means income; the things which are received as a result of some well-specified action. The incremental costs of revenue is the increase in revenue which would result from accept-ing the job. Fixed costs are irrelevant for one shot pricing purposes. If we drop our prices, on the presumption that fixed costs do not matter, then we will run out of business. (Fuller-NWWA) W76-05570

SUPPLY AND DEMAND IN WATER PLANNING: STREAMFLOW ESTIMATION AND CONSERVATIONAL WATER PRICING, Kentucky Water Resources Research Inst., Lex-

For primary bibliographic entry see Field 6D. W76-05607

WATER'S MOST EFFICIENT SYSTEM. The American City, Vol. 90, No. 8, p 39-42, August 1975. 5 fig.

Descriptors: *Water distribution(Applied), *Water supply, *Distribution systems, *Reservoirs,
*Water costs, Computers, Equipment, Automatic
control, Electronic equipment, Economic efficien-

cy, *Texas.
Identifiers: *San Antonio(TX), Edwards Underground Reservoir(TX), Hydrotronics.

Computers, training and business sense help San Antonio (TX) provide quality water at cost-effec-tive rates. Using Edwards Underground Reser-voir, one of the world's largest, most pure subter-ranean water formations, San Antonio serves 160,000 customers. With an initial heavy investment, water supply modernization has resulted in savings of \$2.15 million per year plus the lowest fire insurance rate in Texas. A computer saves fire insurance rate in Texas. A computer saves time and money and serves as a management tool and planning guide. Using a computer control center, the water department monitors all pumping operations and alerts for any change. Other computerized services provide the material supply system with listings of all transactions, daily activities, reporting of personnel, customer service including billing and records at savings of \$300,000 annually. Consolidation of the water system's 26 pumping stations is proceeding with projected savings estimated at \$470,000 per annum upon completion. Preventive maintenance and equip-ment replacement as well as the use of hydrotronics for pipeline inspection and an extensive program of meter replacement and testing have produced great savings. On-going training and safety programs reduce lost time and medical claims by employees. (Salzman - North Carolina) W76-05655

A RURAL MISSISSIPPI SUCCESS STORY: AL-CORN COUNTY'S WATER SYSTEM. For primary bibliographic entry see Field 6D. W76-05657

LOW COST PHOSPHOROUS REMOVAL For primary bibliographic entry see Field 5D.

MINIMAL COST PLANT CLEANING UP HAR-

Albertson, Sharp and Backus, Norwalk, Conn. For primary bibliographic entry see Field 5D. W76-05796

FINANCING THE NEW WATER AUTHORI-TIES,

Thames Water Authority, London (England). E. J. Gilliland.

Water Services, Vol. 79, No. 948, p. 46-54, 1975.

Descriptors: *Public utilities, *Financing, *Cost allocation, Pricing, Rates, Europe, Investment, Income, Loans, Cost repayment, Interest rates, Capital supply. Identifiers: *England, Service charges.

The complex problems faced by the British re-gional water authorities related to financing capital

improvements under the constraints imposed by the government, public resistance to increased charges, and equitable distribution of service charges, and requisible distribution of service charges, are reviewed. It appears that revenue expenditures for all water authorities will rise in 1975-76 by about 35% over the corresponding figures for 1974-75 and, on an average, so will their various charges. The government's decision to treat water authorities as nationalized industries for capital investment purposes was coupled with the provisions in the Water Act restricting their long term borrowing for capital purposes to the National Loans Fund, for a fixed period at a fixed rate of interest; from the European investment Bank subject to its rules; and from other foreign sources subject to Treasury and Bank of England approval. Their borrowing for 1975-76 will have to be met from the NLF for a 25 year period at the prevailing interest rate. Currently the rate is 17-1/4%. This restricted borrowing has lost interest charge savings from 1-1/2-2% in 1975/76 with losses rising to about 8% over the next five years. (Auen-Wisconsin). W76-05810

ECONOMIC MAGNITUDES AND ECONOMIC ALTERNATIVES IN LOWER BASIN USE OF COLORADO RIVER WATER,

Arizona Univ., Tucson. Dept. of Agricultural Economics. For primary bibliographic entry see Field 3A.

W76-05811

MONETARY VALUES OF LIFE AND HEALTH. Tennessee Valley Authority, Knoxville. Flood Control Branch.
For primary bibliographic entry see Field 6F.
W76-05812

INDUSTRIAL COST RECOVERY AND USER CHARGE ASSESSMENTS, Bovay Engineers, Inc., Spokane, Wash.

For primary bibliographic entry see Field 5G.

AN ECONOMIC MODEL OF WATER USE AND WASTE TREATMENT,

Houston Univ., Tex.
For primary bibliographic entry see Field 5D.
W76-05814

THE ECONOMICS OF ALTERNATIVE DEEP SEABED REGIMES, Amos Tuck School of Business Administration, Hanover, N. H.

For primary bibliographic entry see Field 6E. W76-05816

DETAILED ECONOMIC MODELS FOR INDUS-TRIAL AND OTHER ACTIVITIES. Bari Univ. (Italy).

For primary bibliographic entry see Field 5G. W76-05817

EVALUATION OF QUALITY PARAMETERS IN WATER RESOURCE PLANNING: A STATE-OF-THE-ART SURVEY OF THE ECONOMICS OF WATER QUALITY, Bovet (Eric D.) Alexandria, Va.

For primary bibliographic entry see Field 5G. W76-05818

PRINCIPAL ECONOMIC ASPECTS OF THE PROBLEM OF SALINITY OF THE COLORADO

Universidad Nacional Autonoma de Mexico, Mexico City. Centro de Relaciones Internacionales. For primary bibliographic entry see Field 6E. W76-05821

Field 6-WATER RESOURCES PLANNING

Group 6C-Cost Allocation, Cost Sharing, Pricing/Repayment

MEASURING AND MINIMIZING THE SOCIAL COST OF ENVIRONMENTAL POLLUTION, Tennessee Univ., Knoxville. Center for Business and Economic Research. For primary bibliographic entry see Field 5G. W76-0582.

WILLINGNESS TO PAY AS A BEHAVIOURIAL CRITERION FOR ENVIRONMENTAL DECISION-MAKING.

Waterloo Univ. (Ontario). Dept. of Man-Environment Studies. For primary bibliographic entry see Field 5G.

UTAH'S THIRD YEAR OF PLANNING FOR THE FOUR CORNERS REGIONAL COMMIS-

Utah Planning Commission, Salt Lake City. For primary bibliographic entry see Field 6B. W76-05827

W76-05826

COMPARATIVE RISK-COST-BENEFIT STUDY OF ALTERNATIVE SOURCES OF ELECTRICAL ENERGY.

CAL ENERGY, Atomic Energy Commission, Washington, D. C. For primary bibliographic entry see Field 6B. W76-05829

RESTORING THE QUALITY OF URBAN RECEIVING WATERS: INTERFACING UP-GRADED TREATMENT FACILITIES WITH THE STREAM,

Clemson Univ., S. C. Dept. of Environmental Systems Engineering. For primary bibliographic entry see Field 5D.

LIME USE IN WASTEWATER TREATMENT: DESIGN AND COST DATA, Brown and Caldwell, Walnut Creek, Calif. For primary bibliographic entry see Field SD.

THE ECONOMICS OF CLEAN WATER. VOLUME III. INDUSTRY EXPENDITURES FOR WATER POLLUTION ABATEMENT.
Conference Board, Inc., New York.
For primary bibliographic entry see Field 5G.
W76.0901

6D. Water Demand

W76-05868

YUKON CITY'S NEW WELL REPLACES FIVE OLDER ONES,

Hydrogeological Consultants Ltd., Edmonton (Alberta).

For primary bibliographic entry see Field 4B. W76-05566

SUPPLY AND DEMAND IN WATER PLANNING: STREAMFLOW ESTIMATION AND CONSERVATIONAL WATER PRICING, Kentucky Water Resources Research Inst., Lex-

ington.
D. I. Carev, and C. T. Haan.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 159, \$7.50 in paper copy, \$2.25 in microfiche. OWRT A-052-KY(2), 14-31-0001-4017, 14-31-0001-5017, Research Report No. 92, January, 1976. 174 p, 9 fig, 28 tab, 49 ref.

Descriptors: *Pricing, Water rates, *Water demand, Reservoir storage, *Water supply, *Kentucky, *Reservoir design, Planning, Streamflow forecasting, Estimating, Model studies, Stochastic processes, Hydrologic data.

This study was undertaken to provide methods in water supply reservoir design that increase system benefits. Two major factors influencing reservoir design were studied: estimated future streamflow into the reservoir and demands placed on the reservoir. To assess the reliability of a design. mathematical models were used in simulation studies. A methodology was presented to evaluate the ability of a parametric model to improve the ability of a parametric model to improve the stochastic model parameter estimates. A modified Markov Chain model was proposed which used continuous distributions, rather than discret transition probabilities, to represent the process when rainfall actually occurred. A two-parameter gamma distribution fit the data. Fifteen-20 years of historical daily rainfall data were required to produce stable estimates of model parameters. The second part of the study was undertaken to see if benefits to a hypothetical community from water supply could be increased by utilizing price-demand information in reservoir design studies. Three pricing policies were examined and their effect on reservoir design determined. The use of the conservation pricing policies substantially reduced storage requirements while providing increased, demonstrable net benefits to the community. The conservation pricing policies substantially lowered the average price paid for water. The effect of uncertainty in consumer response to changes in price was studied by using a probabilitistic price-de-mand relationship. (Huffsey-Kentucky)

HOW TO GUIDE GROWTH IN SOUTHEAST-ERN NEW ENGLAND, PARTS I, II AND IV OF THE DRAFT REPORT.

New England River Basins Commission, Boston, Mass. Southeastern New England Study. For primary bibliographic entry see Field 6G.

A RURAL MISSISSIPPI SUCCESS STORY: AL-CORN COUNTY'S WATER SYSTEM.

Appalachia, Vol. 8, No. 4, p 32-39, 14 fig, 1 tab. February-March 1975.

Descriptors: *Water resources development, *Planning, *Water supply, *Regional development, *Water distribution, *Mississippi, Social aspects, Water requirements, *Rural areas, Costs. Identifiers: *Appalachian Regional Commission(ARC), *Alcorn County(MS), Northeast Mississippi Planning and Development District, *Citizen participation, Local development district(LDD).

Water shortage as well as water pollution has long plagued 866 families of Alcorn County, Mississippoi in the northwest Appalachian region of the state. During the 1960's, an industrial and housing boom, as well as several federal and state projects, such as the Tuscumbia River watershed project, triggered an increasing demand on an inadequate water supply. Pump breakdown, dried up wells, contaminated shallow wells and cisterns, bitter water tasting of iron and all-too-frequent water hauling expeditions characterized the old water system. Community action which produced preliminary surveys and engineering studies for feasibility resulted in two plans. The Northeast Mississippi Planning and Development District consolidated the plans and broadened their scope to create the Alcorn County Water Association. The plan consists of a water supply and distribusystem in a 70 sq mi area and includes 2 wells, 3 storage tanks and a treatment plant to reduce iron content. Over 100 miles of pipes have been laid. For minimum service monthly bills run to about \$6 per family. Financial problems include paying off loan and other debts, lack of new customers as new home construction drops, and high initial cost of installation and connection to main line. However, the growth potential and tenacity and determination of residents are great. (Salzman-North Carolina)

WATER AND ITS ROLE IN THE WORLD (WASSER UND WAS ES IN DER WELT DAMIT AUF SICH HAT), W. Brecht.

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Das Papier, Vol. 29, No. 10A, p V58-61, Oct., 1975. 3 fig, 10 ref. English summary.

Descriptors: *Water supply, Hydrologic data, Natural resources, Water resources, *Water demand.

In a time when questions are being asked as to how man can harmonize the steady increase in his consumption of natural materials with the fact of vanishing world resources, it is striking that water is seldom mentioned. Some data on the world water supply are briefly discussed with respect to the ability to meet future demand. (Speckhard-IPC) W76-05739

THE MASTER PLAN FOR WATER SUPPLY IN THE REGIONAL MUNICIPALITY OF OTTAWA-CARLETON,

Ottawa-Carleton Regional Municipality (Ontario). F. E. Ayers.

Journal of the American Water Works Association, p. 1-5, January 1975. 5 fig.

Descriptors: *Future planning(Projected), *Water supply, *Water works, Water distribution(Applied), Canada, Cities, *Water demand, *Regional analysis.

Identifiers: Ontario.

A short-term water servicing plan developed by the regional municipality of Ottawa-Carleton to serve an estimated population of 635,000 anticipated to occur by 1990 and a long-term plan based on an anticipated population of 1 million not later than 2030 and not prior to 2000 are described. A study indicated that the most efficient system would be one where the pumping stations were designed to meet the average water demand for the maximum day of consumption with peak hourly rates being met through outflow from reservoirs The sizing of all water mains has been determined on the basis of imposing the average demand for the maximum day's consumption plus potential fire-fighting flows while maintaining residual pressures at the fire load point of not less than 20 psi. The size of water mains at lower elevations should not exceed 100 psi and at the higher elevations should not be less than 40 psi under all operating conditions except for fire flows. Existing purification plants can be uprated in filter capacity to meet estimated maximum-day demand to 2030. Major pumping station improvements will need to be undertaken and additional storage capacity will be required. The system components are described. (Auen-Wisconsin) W76-05815

AN ECONOMIC ANALYSIS OF WATER USE IN COLORADO'S ECONOMY,

Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 6B.

APPLICATION OF MULTI-REGIONAL PLANNING MODELS TO THE SCHEDULING OF LARGE-SCALE WATER RESOURCE SYSTEMS DEVELOPMENT,

Geological Survey, Reston, Va. For primary bibliographic entry see Field 6A. W76-05846

NORTHERN GREAT PLAINS RESOURCE PRO-

Northern Great Plains Resources Program, Denver, Colo. Draft Report, Sept. 1974. 163 p, 72 tab, 30 fig, 16 nlates Descriptors: *Coal mines, *Environmental effects, *Great Plains, *Water resources development, *Water table aquifers, Water storage, Water pollution, Leaching, Wells, Irrigation, Municipal ponution, Learning, well-sp, frigation, Mulin-spa water, Water allocation(Policy), Consumptive use, Water demand, Surface ground water relation-ships, Water levels, Indian reservation, Water rights, Waste water treatment, Evaporation. Identifiers: *Northern Great Plains.

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Examined in this section are the interrelationships between energy development and water in the Northern Great Plains. Since the plains are semiarid, much of the readily available water supply is already being used to near capacity, the major consumptive uses being irrigation and evaporation from reservoirs. Thus an extensive energy development program, such as is planned for coal mining in the region, will place strain on the available water supplies and compel the finding of new water sources, even though sufficient water may be available to meet both future agricultural and industrial demands, the price of water will effect its uses. Other factors that must be considered include: (1) municipal water needs; (2) effects on agricultural and wildlife areas; (3) Indian water rights; and (4) ecological effects of mine wastes. The primary consideration up to this time, how-ever, has been the extent to which coal mining may disturb areas of water recharge and alter regional water tables. (Parrish-Florida) W76-06050

6E. Water Law and Institutions

A CASE STUDY REPORT ON THE VISTULA RIVER BASIN,

Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering. For primary bibliographic entry see Field 4A. W76-05514

RECENT TRENDS IN WATER QUALITY MANAGEMENT AND PROTECTION IN HUN-

GARY, National Water Authority, Budapest (Hungary). Water Pollution Control. For primary bibliographic entry see Field 5G. W76-05518

WATER RESOURCES DEVELOPMENT IN THE TISZA RIVER BASIN AND ITS IMPACT ON SOCIO-ECONOMIC GROWTH.

Water Management Center, Budapest (Hungary). Dept. of Long Range Planning. For primary bibliographic entry see Field 4A. W76-05519

VIEWS ON RIVER BASIN DEVELOPMENT IN THAILAND,

Bangkok Metropolitan Water Works Authority (Thailand).

For primary bibliographic entry see Field 4A. W76-05520

GOALS AND FORMS OF CO-OPERATION AMONG COUNTRIES FOR THE DEVELOPMENT OF INTERNATIONAL RIVER BASINS, Research Inst. for Water Resources Development,

Budapest (Hungary).
For primary bibliographic entry see Field 4A.
W76-05521

HISTORY OF GROUND WATER DEVELOP-

National Water Well Association, Worthington, Ohio. For primary bibliographic entry see Field 4B. W76-05556

JUDGING THE AVAILABILITY OF GROUND WATER.

For primary bibliographic entry see Field 4B W76-05558

THE SAFE DRINKING WATER ACT OF 1974: A MANAGEMENT IMPACT STATEMENT. For primary bibliographic entry see Field 5G. W76-05656

URBAN WATER MANAGEMENT OF AN INTERNATIONAL RIVER: THE CASE OF EL PASO -JUAREZ,

University of Western Ontario, London. Dept. of Geography.

For primary bibliographic entry see Field 3D. W76-05661

EFFLUENT DISCHARGE LAW-BURDENS AND CONSEQUENCES FOR THE PAPER INDUSTRY

))(ABWASSERABGABENGESETZ-BELASTU'S UND FOLGERUNGEN FUER DIE PAPIERIN-DUSTRIE),

Technische Universitaet, Darmstadt (West Germany). Wasser- und Abwasserforschungsstelle. For primary bibliographic entry see Field 5G. W76-05712

STATUS OF WATER POLLUTION CONTROL IN THE SOVIET UNION, Crown Zellerbach Corp., Camas, Wash. For primary bibliographic entry see Field 5G.

W76-05714

REAL-TIME MANAGEMENT OF WATER-RESOURCE SYSTEMS,

Thames Water Authority, Reading (England).
Operational Research Unit. For primary bibliographic entry see Field 6A. W76-05747

EX-POST EVALUATION OF RIVER BASIN DEVELOPMENTS IN PAKISTAN,

Arizona Univ., Tucson.
For primary bibliographic entry see Field 6A.
W76-05748

THE CZECHOSLOVAK WATER DEVELOP-MENT PLANNING APPROACH AND ITS AP-

PLICATION,
Ministry of Forest and Water Management,
Prague (Czechoslovakia). For primary bibliographic entry see Field 6A. W76-05749

EVALUATION OF THE EFFECTS OF WATER

TRANSFER, Research Inst. for Water Resources Development, Budapest (Hungary). For primary bibliographic entry see Field 6A. W76-05751

INTER BASIN TRANSFER OF WATER RESOURCE CASE STUDY OF INDUS PRO-JECT, West Pakistan Water and Power Development

Authority, Lahore. For primary bibliographic entry see Field 4A.

TECHNICAL-ECONOMIC PLANNING OF THE GABCIKOVO-NAGYMAROS BARRAGE PRO-JECT FOR THE DEVELOPMENT OF THE CEN-

TRAL-DANUBE BASIN, National Water Authority, Budapest (Hungary). For primary bibliographic entry see Field 4A. W76-05754

INTERNATIONAL MANAGEMENT OF THE RIVER PLATE BASIN,
University of Western Ontario, London. Dept. of

Geography. For primary bibliographic entry see Field 4A. W76-05756

SIMULATION AS A TOOL IN INTERNA-TIONAL RIVER DEVELOPMENT, Karlsrube Univ. (West Germany). Institut fuer

Wasserhan III For primary bibliographic entry see Field 6A. W76-05757

INTERNATIONAL RIVER BASIN COOPERA-TION: SOME FACTORS INFLUENCING AGREEMENT, British Columbia Univ., Vancouver. Westwater

Research Centre. D. LeMarquand.

Working Paper No. 33, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 20 p.

Descriptors: *River basin development, *Agreements, *International law, *Water policy, International commissions, Economics, Hydrology, Navigation, Decision making.

Identifiers: *International cooperation, Develop-ing cuntries, Riparian countries, Economic incen-tives, Linkage, Reciprocity, Sovereignty.

River systems shared between two or more countries form a significant portion of the world's fresh water resources. These resources are often a vital asset for countries trying to cope with population growth and improving the quality of life. How-ever, political difficulties create real barriers in the way of cooperative use between basin countries and lead to the under-utilization or misuse of these shared resources. This paper attempts to identify the types of considerations that facilitate or hinder international river agreements. Three ranges of factors are considered: 1) incentives and disincenractors are considered: 1) incentives and disincer-tives influencing cooperation arising from the hydrologic-economic pattern of development within a basin; 2) policy formulation within a na-tional government that is often shaped by a range of international relations influences that a country considers important; and 3) the decision-making process for international rivers within government that may work against effective national participation and commitment in negotiations to settle river basin issues. The above political influences limit the role international commissions and internathe role international commissions and interna-tional organizations can have in promoting cooperation; nevertheless, within these con-straints, the organizations can perform some func-tions that facilitate cooperation. These observa-tions are drawn from a general literature review and more detailed studies of five river basins in Europe and North America. Further research is constituted to the property of the contractions of the conrequired to gain insights into international river issues in less developed countries. (Bell-Cornell) W76-05758

LEGAL FRAMEWORK OF CO-OPERATION IN THE FIELD OF WATER MANAGEMENT BETWEEN HUNGARY AND HER NEIGHBOR-ING COUNTRIES, National Water Authority, Budapest (Hungary).

Working Paper No. 34, UNDP/UN Interregional Seminar on River Basin and Interbasin Develop-ment, Budapest, Hungary, September 1975. 15 p.

Descriptors: *River basin development, *Water management(Applied), *Legal aspects, Riparian waters, Agreements, Water pollution control, Water law.

Identifiers: *International cooperation, *Hungary, *Danube River basin, Tisza Valley.

The Carpathian Basin lies along the middle course of the Danube River. There are six countries shar-

Field 6-WATER RESOURCES PLANNING

Group 6E-Water Law and Institutions

ing the catchment area of the river of about 300.000 km2. The cooperation in the field of water management of the co-basin States is coordinated by bilateral agreements concerning the frontier waters. These agreements regulate the relations of the concerned countries in different fields of water management, such as allocation of water resources, the construction and maintenance of beds of frontier rivers, cooperation in flood control, etc. In all these cases, the implementation of agreements is advanced by joint committees. There are some questions which necessitate the multilateral cooperation of the cobasin States. Thus, there is a cooperation between five countries concerned in the Tisza valley for the checking-up plans for water management. The or-ganization of the cooperation of countries concerned in the Danube Basin is under preparation in the fields of water quality control, setting up of water balance, and flood control. There are special agreements under preparation for planning and executing common water management projects. Among these, the most significant one is the Nagymaros which will be carried out in the framework of Hungarian-Czechoslovakina cooperation. (Bell-Cornell) W76-05759

WATER RESOURCES DEVELOPMENT IN THE GANGA-GHAGRA INTERBASIN IN UTTAR PRADESH (INDIA).

Central Board of Irrigation and Power, New Delhi

For primary bibliographic entry see Field 4A. W76-05763

THE ECONOMICS OF ALTERNATIVE DEEP SEARED REGIMES.

Amos Tuck School of Business Administration, Hanover, N. H.

D. E. Logue, R. J. Sweeney, and B. N. Petrou Marine Technology Society Journal, Vol. 9, No. 4, p. 8-16, 1975.

Descriptors: *Mining, *Regulation, *Oceans, *Law of the Sea, United Nations, Exploitation, Exploration, Evaluation, United States, Competition, Monopoly.

Identifiers: International Seabed Resource Authority.

The proposals of various sovereign states for an International Seabed Resource Authority debated at the U.N. Law of the Sea Conference are analyzed as to how they impinge on U.S. economic interests. The most economically beneficial is the U.S. Draft Treaty of 1970 which proposed a freeaccess registry type of ISRA, a first-come-firstserved with auction system to settle competing claims. The many foreign proposals for a strong monopoly Enterprise, controlling virtually all aspects of exploration and exploitation, are harmful to U.S. and world economic interest. Many of the Less Developed Countries (LDCs) which are presumed to benefit from such an Enterprise ould in fact suffer. The various proposals by the LDCs, France, and the USSR are analyzed with regard to economics and accruing benefits. It is postulated that no need exists for regulation at all. In the foreseeable future, the principal economic activity on the abyssal floor beyond 200 miles from land, or beyond the 3000 m iso-bath, will be nodule mining. On the surface the mining ship is governed by the long-standing maritime rules-of-the-road. The miner's home country could institute needed regulation as it is much more likely to fairly balance the costs and benefits than would an international group that would inevitably be influenced by political ideologies. (Auen-Wisconsin). W76-05816

PRINCIPAL ECONOMIC ASPECTS OF THE PROBLEM OF SALINITY OF THE COLORADO

Universidad Nacional Autonoma de Mexico. Mexico City. Centro de Relaciones Internacionales. E. H. Vela Salgado.

Natural Resources Journal, Vol. 15, No. 1, p. 129-133, 1975. 10 ref.

Descriptors: *Colorado River, *Mexico, *Salinity, Prestings, Arizona, Agriculture, Economic impact, Irrigation effects, Compensation, Water law, *United States, International law.

Identifiers: Mexicali Valley(Mexico).

The increased salinity of the Colorado River water delivered to the Mexicali Valley, Mexico has adversely affected crop production, causing great economic losses; it has raised production costs, and increased research expenditures to develop salinity resistant crops, culminating in permanent repercussions on regional labor sources and public services. Efforts made by the United States to reduce the salinity content of water delivered to Mexico have been ineffective and pursuant to Minute 243 to the Treaty of 1944, signed in 1973, a desalination plant will be built by the U.S. together with an extension of the canal that drains salt water from the Morelos Dam to the Gulf of California. The U.S. is expected to prevent this drainage water from containing radioactive materials or other pollutants. The U.S. is also committed to support Mexican efforts to obtain appropriate financing, on favorable terms, for the improve-ment and rehabilitation of the Mexicali Valley and to give 'non-reimbursable' technical assistance. Mexico is abandoning its right to claim idemnification due for past damages and appears to be resigned to accepting the promise of loans and nonpayable assistance but fears are expressed that the drainage canal will contaminate the Gulf of California. The U.S. lagging efforts to alleviate the problem are criticized. (Auen-Wisconsin) W76-05821

INSTITUTIONAL CONSTRAINTS AND CON-JUNCTIVE MANAGEMENT RESOURCES IN WEST TEXAS, OF WATER

Texas Tech Univ., Lubbock. Dept. of Geography. O. W. Templer.

Available from the National Technical Information Service, Springfield, Va 22161 as PB-251 379, \$10.00 in paper copy, \$2.25 in microfiche. OWRT A-029-TEX (1) 14-31-0001-5044 14-3 -0001-6045 Texas Water Resources Center, Lubbock, Technical Report No WRC-76-1, February, 1976. 119 p.

Descriptors: *Water law, *Water right, Hydrologic cycle, Legal aspects, *Conjunctive use, *Texas, Water management(Applied), Arid lands, Social change, *Institutional constraints, Social adjust-

Identifiers: West Texas.

The critical interaction between existing legal institutions (Texas water law and water rights) and the limited water resources of arid and semiarid West Texas is examined. The legal division of water in various phases of the hydrologic cycle into different classes and recognition of welldefined water rights in the separate phases present problems to the coordinated, efficient use and management of water resources. Conjunctive use and management of interrelated water resources, practiced in only a few states, is generally considered desirable. However, correlated management cannot be effectively accomplished under present Texas law. Many examples of the problems which relate to, or result from, Texas water law are given. Any revision of Texas law, particularly groundwater law, will be difficult to impose, primarily because of the very large nber of recognized private water rights and the political power inherent in them. Change can best be achieved through education of water users and the public to desirable alternatives, a lengthy process. Data necessary for operation of conjunctive management systems are generally being acquired, and perhaps someday other water phases can be integrated with surface and groundwater. However, Texas courts and the legislature have sufficient information on the interrelated hydrologic cycle so that prospective water conflicts should be foreseen and avoided. The greatest care must be used in recognition of new types of private water rights or extension of existing rights, because this institutional structure, once established, presents a formidable obstacle to needed change. W76-05842

INTERIM REPORT ON THE IMPACT OF PUBLIC LAW 92-500 ON MUNICIPAL POLLUTION CONTROL TECHNOLOGY,

Municipal Environmental Research Lab., Cincinnati Ohio. For primary bibliographic entry see Field 5D.

W76-05867

ILLINOIS DRAINAGE LAW--THE DOMINANT ESTATE OWNER MAY NOT INCREASE THE RATE OR AMOUNT OF SURFACE WATER RUN-OFF ONTO THE SERVIENT ESTATE
BEYOND A RANGE CONSISTENT WITH A
POLICY OF REASONABLE USE,
For primary bibliographic entry see Field 4A.

W76-06051

LEGISLATIVE BARGAIN AND THE DOCTRINE OF REPEAL BY IMPLICATION (DISCUSSION OF CASE INVOLVING (DISCUSSION OF CASE IN COLORADO RIVER STORAGE ACT). For primary bibliographic entry see Field 4A. W76-06052

THE INTERNATIONAL LAW ASPECTS OF THE GARRISON DIVERSION PROJECT. S. E. Gaines.

Environmental Law Reporter, Vol. IV; p. 50085-50100, 1974, 16 p.

Descriptors: *Irrigation programs, *Watershed management, *International Joint commission, *Canada, *United States, Federal Government, North America, Boundaries(Property), Interstate compacts, Water law, Irrigation, Water supply, North Dakota, Water pollution, International law, Saline water intrusion, Floods, State governments, Costs, Agriculture diversion.

Identifiers: *Garrison Diversion

Project. *Boundary Waters Treaty of 1909, Injunctive re-

The Garrison Diversion Project under the Bureau of Reclamation seeks to withdraw water from the Missouri River for irrigation of 250,000 acres of farmland in semi-arid areas of North Dakota. Seventy-five percent of the acreage is situated in the watersheds of the Souris and Red Rivers which flow into Canada. Canada has filed formal complaint with the United States, alleging that the project will subject the Souris River to increased flooding and higher salinity levels, both violations of the Boundary Waters Treaty. To date neither government has sought to place the matter before the International Joint Commission having jurisdiction in the matter. In light of their complications, and waning Congressional support, the author recommends redrafting the project as an international endeavor by both countries. (Gerlach-W76-06053

CONGRESS ORDERS MORITORIUM ON GAR-RISON DIVERSION UNIT.

Environmental Law Reporter, Vol. 5, No. 8, p. 10131-10136 (1975). 6 p, 12 ref.

Descriptors: *Irrigation programs, *Diversion, *Canada, *International law, *Environmental effects, Water pollution, Legal aspects, Legislation, Water law, Project planning, Treaties, Costbenefit analysis, Water pollution sources, Water pollution abatement, Fishkill, Path of pollutants, Turbidity, Eutrophication, Salinity, Saline water intrusion, Irrigation effect, United States. Identifiers: *Garrison Diversion Project, *Boundary Waters Treaty of 1909, Environmental impact statements.

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impact statements.

In June 1975, Congress ordered a temporary halt to the Garrison Diversion Unit (GDU), a massive irrigation project which, when complete, would divert huge quantities of water from Lake Sakakawea into the Souris, James and Sheyenne rivers. Opponents of the Garrison Diversion Unit view the project's environmental impact statement as vague inadequate and perhaps intentionally deceptive, and argue that predicted benefits from the project have been grossly overstated while reported costs have failed to take into account detri-mental environmental effects. These opponents call for more extensive studies to determine the true cost-benefit ratio. Even greater opposition to the project comes from Canada. Canadians claim the project could cause sever adverse effects to the Canadian environment in the form of increased water salinity, increased turbidity, and depleted gamefish populations. The way in which the De-partment of the Interior resolves or fails to resolve the GDU project in the coming months will influence Canadian-American relations in the future (Nursey-Florida) W76-06054

THE TAKING ISSUE: POTENTIAL OBSTACLE TO NATURAL RESOURCE MANAGEMENT LEGISLATION,

Oregon Univ., Eugene. School of Law. R. Benner.

Oregon L. Rev, Vol. 54, No. 1, p. 67-79 (1975), 13 p.

*Legal Descriptors: aspects, *Eminent *Oregon. *Constitutional law, domain, *Constitutional law, *Eminent domain, *Resources development, Regulation, State governments, Legislation, Local governments, Water law, Water resources, Development, Management, Water management(Applied), Planning, Natural resources, Resource allocation, Natural Resources, Resources, Natural Resources, Resources, Natural Water quality, Water quality control, Water policy, Water rights, Administration, Governments, Environmental effects, Water quality. Identifiers: Coastal management.

Debated here is whether a regulatory scheme created under natural resource management legislation can so encumber the use of property as to constitute an unconstitutional taking of the property without compensation. In most cases, as long as the legislation protects the health, safety or long as the legislation protects the heath, safety or welfare of the people and the regulation is not clearly unreasonable or arbitrary, it should be valid. However, if the regulation causes such a diminution in the value of the affected property that no reasonable use of the property remains, the court may find an unconstitutional taking. No court, as yet, has established a fixed percentage of value loss constituting a taking. As environmental awareness grown, regulations implemented for en-vironmental purposes are more likely to be found reasonable and, therefore, constitutionally valid. In order to avoid constitutional difficulties, drafters of natural resource management legislation should avoid regulations which appear to regulate property solely for public purposes, since legisla-tion supported by specific ecological data is more likely to overcome a taking claim. (Nurseylikely to Florida) W76-06055

THE WASHINGTON SHORELINE MANAGE-MENT ACT,
For primary bibliographic entry see Field 5G.
W76-06056

COASTAL ZONE MANAGEMENT AND INTER-GOVERNMENTAL COORDINATION, Louisiana State Univ., Baton Rouge. Law School. M. J. Hershman, and J. C. Folkenroth. Oregon Law Rev, Vol 54, No 1, p 13-33 (1975). 82

Descriptors: *Comprehensive planning, *Governmental interrelations, *Resources development, *Coordination, *Federal-state water development, "Coordination, "Federal-state water rights conflicts, Legal aspects, Legislation, Federal government, State governments, Local governments, Water law, Competing uses, Water resources development, Management, Water management(Applied), Planning, Natural resources, Resource allocation, Water quality, Water quality control, Water policy, Administration, Water guildization

tion, Water utilization.

Identifiers: *Coastal Zone Management Act of 1972, Interagency coordination.

State resource management agencies have had difficulty resolving conflicts among competing resource uses because such agencies traditionally have been responsible only for specific resource problems. The 1972 Coastal Zone Management Act (CZMA) provides opportunities for state governments to receive federal funds to aid in developing coordinated management programs for coastal zone land and water use. Although CZMA should aid in creating more effective state coastal zone management, its effect may be diminished by inadequate funding and conflicts with other federal agencies. The program must coexist with federal laws and programs which directly concern coastal resource management. Whenever federal law directly conflicts with a state's coastal zone management program, the state program must yield to federal law. When these conflicts are not yietu to rederat law. When these conflicts are not irreconcilable, however, the interagency coordination clauses of CZMA require that federal activities be conducted consistently with approved state programs to the maximum extent practicable. (Nursey-Florida)

REFORMING PROCEDURES FOR INDUSTRI-AL SITING. J. T. Greene

American Bar Association Journal, Vol. 61, p. 449-452. April. 1975.

Descriptors: *Sites, *Decision making, *Industrial plants, *Land use, *Environmental effects, Legal aspects, Economic feasibility, Social values, Environmental Protection Agency, Governmental interrelations, Adoption of practices, Regulation, Administrative agencies, Administrative decisions, State governments, Federal governments, Jurisdiction, Coordination, Construction,

Economic impact.
Identifiers: *Council of Environmental Quality, Reform, Generating plants, Hearings.

This article is a study by the American Bar Association Special Committee on Environmental Law outlining legal reforms needed in the deci-sion-making process in industrial siting. Good, comprehensive, coordinated legal mechanisms for comprehensive, coordinated legal mechanisms for arriving at sting decisions are lacking in almost every state, resulting in inordinate delays in industrial development and inadequate protection of the environment. The study's primary recommendation is that a single state agency should have jurisdiction over all applications to site major industrial facilities. This would eliminate the duplication of hearing and a series eliminate the duplication trial facilities. This would eliminate the duplication of hearings and permit applications that currently prevails. Agency decisions would be subject to review by the highest appellate state court. They would be made after due consideration and balancing of all relevant factors, environmental, social, and economic. A similar agency should be created on the federal level to review the siting decisions of federal agencies. The study also recommends that when both federal and state permits are required for a project, a single environmental evaluation should be conducted. (Parrish-Florida)

CERTAIN LAND USE REGULATIONS TO PRO-TECT FROM DANGER OF FLOODING. Nags Head Town Council, Nags Head, N.C. For primary bibliographic entry see Field 6F. W76-06059

SUGGESTED PROVISIONS TO BE USED IN ZONING ORDINANCES FOR COMPLIANCE WITH SECTIONS 1910.3(C) OF THE NATIONAL FLOOD INSURANCE PROGRAM. For primary bibliographic entry see Field 6F. W76-06060

CORPS ISSUES INTERIM RULES FOR DISCHARGES OF DREDGED AND FILL MATERIALS. For primary bibliographic entry see Field 5G. W76-06061

ALASKA OIL POLLUTION REGULATIONS. For primary bibliographic entry see Field 5G. W76-06062

STATE WATER QUALITY CONTROL FUND. For primary bibliographic entry see Field 5G. W76-06063

CLEAN WATER GRANT PROGRAM. For primary bibliographic entry see Field 5D. W76-06064

DISCHARGE REPORTS AND WASTE REQUIREMENTS. For primary bibliographic entry see Field 5G. W76-06065

CERTIFICATION OF CONFORMANCE WITH WATER QUALITY STANDARDS.
For primary bibliographic entry see Field 5G.

MICHIGAN WASTEWATER REPORTING AND SURVEILLANCE FEES RULES. Michigan Dept. of Natural Resources E. Lansing. Water Resources Commission. For primary bibliographic entry see Field 5G. W76-06067

MICHIGAN WATER RESOURCES COMMIS-SION ACT. For primary bibliographic entry see Field 5G.

REGULATIONS PERTAINING TO WASTE DISCHARGE PERMITS. For primary bibliographic entry see Field 5G. W76-06069

DEPOSIT OF MOTOR VEHICLE BODIES AND ACCESSORIES INTO THE WATERS OF THE For primary bibliographic entry see Field 5G. W76-06070

REGULATIONS PERTAINING TO OIL SPILLS INTO PUBLIC WATERS.
For primary bibliographic entry see Field 5G.
W76-06071

CONFINED ANIMAL FEEDING OR HOLDING OPERATIONS. For primary bibliographic entry see Field 5G. W76-06072

Field 6-WATER RESOURCES PLANNING

Group 6E-Water Law and Institutions

STATE FINANCIAL ASSISTANCE TO PUBLIC AGENCIES FOR POLLUTION CONTROL FACILITIES.

For primary bibliographic entry see Field 5G.

SOUTH DAKOTA WATER POLLUTION LAW. For primary bibliographic entry see Field 5G. W76-06074

SOUTH DAKOTA ENVIRONMENTAL POLICY ACT.

For primary bibliographic entry see Field 5G. W76-06075

SOUTH DAKOTA WATER QUALITY STANDARDS.

For primary bibliographic entry see Field 5G. W76-06076

UTAH WATER POLLUTION CONTROL ACT. For primary bibliographic entry see Field 5G. W75-06077

UTAH DEFINITIONS AND GENERAL REQUIREMENTS.

For primary bibliographic entry see Field 5G. W76-06078

NEBRASKA LIVESTOCK WASTE CONTROL REGULATIONS.

For primary bibliographic entry see Field 5G. W76-06079

SUBMERGED LANDS LEGISLATION AFFECT-ING GUAM, THE VIRGIN ISLANDS, AND AMERICAN SAMOA (HR 11559).

Hearing--Subcomm. on Territories and Insular Affairs, Comm. on Interior and Insular Affairs, U.S. Senate, 93rd Cong, 2d Sess, June 19, 1974. 41 p.

Descriptors: *United States, *Virgin Islands, *Legislation, *Boundaries(Property), *Beds, Ownership of beds, Legal aspects, Water law, Water rights, Federal government, Governmental interrelations, Jurisdiction, Federal jurisdiction, Foreign waters, International law, Tidal marshes, Islands.

Identifiers: Congressional hearings, *Guam, *American Samoa, Coastal zone management, Coastal waters.

This hearing before the Senate Committee on Interior and Insular Affairs considers a bill which would transfer to the territories of Guam, the Virgin Islands and American Samoa all right, title and interest of the United States to tidelands and submerged lands surrounding the three territories, with certain specified exceptions. Presented are reports from the Interior, Navy and Justice Departments which generally support the bill. However, the Department of the Navy objects to one section of the bill which would permit the Secretary of the Interior to convey certain lands without the approval of the Secretary of Defense. An amendment is therefore proposed. Delegates from the affected territories present other favorable testimony. The hearing concludes with a recommendation for passage of the bill with the Navy amendment. (Nursey-Florida)

TO AMEND THE WILD AND SCENIC RIVERS ACT (ON S. 10 AND S. 1004).

Hearing-Subcomm on Environment and Land Resources, Comm. on Interior and Insular Affairs, US Sen, 94th Cong, 1st sess, July 6, 1975. 39 p, 2 map. Descriptors: "Wild and Scenic Rivers Act, "Rivers, "Legislation, "Conservation, Water resources development, Legal aspects, Water law, Water quality control, Natural resources, Fishing, Federal government, Local governments, Water conservation, Water management(Applied), Recreation, Navigable rivers, River regulation, Interstate rivers, Wild rivers, River systems.

Identifiers: Congressional hearing, Senate Subcommittee on the Environment of Land Resources, *Allegheny River, *Housatonic River.

The United States Senate Committee on the Environment and Land Resources held a hearing to discuss proposed legislation to add the Housatonic River and a section of the Allegheny River to the National Wild and Scenic Rivers System. The Subcommittee received letters from the Department of the Interior stating that the Department had no objectives to the proposed bills. Statements were received from the sponsors of the bills, Senators Ribicoff and Scott, and from river conservation groups generally supporting the bills. The Subcommittee also received a statement from Representative Moffett from the Sixth Congressional District of Connecticut stating his opposition to the bill affecting the Housatonic River. Representative Moffet's position was that protecting the river could be accomplished best on a local level. (Nursey-Florida)

THERMAL PROCESSING AND LAND DISPOSAL OF SOLID WASTE.
Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5D. W76-06082

EVALUATION OF ECONOMIC BENEFITS FOR FLOOD CONTROL AND WATER RESOURCE PLANNING.

Corps of Engineers, Washington, D.C. For primary bibliographic entry see Field 4A. W76-06083

DESIGNATION AND DETERMINATION OF REMOVABILITY OF HAZARDOUS SUBSTANCES FROM WATER. Environmental Protection Agency, Washington,

D.C. For primary bibliographic entry see Field 5G. W76-06084

TIMBER PRODUCTS PROCESSING POINT SOURCE CATEGORY--EFFLUENT GUIDELINES AND STANDARDS.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G. W76-06085

PLASTICS AND SYNTHETICS POINT SOURCE CATEGORY (PROPOSED EFFLUENT LIMITATIONS AND GUIDELINES).

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G. W76-06086

STATE V. GRIFFITH (PRIVATE CLAIM TO TIDELANDS).
216 SE2d 765-767 (S Ct SC 1975), 3 p.

Descriptors: *Boundary disputes, *Ownership of beds, *South Carolina, *Boundaries(Property). *Judicial decisions, Legal aspects, State governments, Water law, Navigable waters, Bodies of water, Tides, Tidal effects, High water mark, Low water mark, Riparian rights, History, Tidal waters, Real property. The State of South Carolina appealed from a judgement sustaining a private landowner's claim to an area of tidelands adjacent to a creek. The private landowner claimed title under a grant given one of his forebears by the Lords Proprietors in 1717. South Carolina contended that title to the tidelands in question had not been conveyed by any such grant and thus remained in the state. The Supreme Court of South Carolina held that, where no plat was attached to the grant which gave as a boundary a tidal navigable stream, and where no language in the grant signified a specific intent to convey title to any land below the usual high-water mark, the grant was insufficient in and of itself to convey title to the disputed tidelands. (Nursey-Florida)

WILLIAMS V. DUKE POWER CO. (SILTING OF STREAM, PONDS, AND LAKE). 216 SE2d 482-487 (Ct. App. N.C. 1975). 6 p.

Descriptors: *Adjacent land owners, *North Carolina, *Negligence, *Judicial decisions, *Water pollution effects, Legal aspects, Penalicis(Legal), Water law, Legal review, Utilities, Water pollution sources, Water pollution, Pollutants, Vegetation, Surface water, Drainage, Silting, Surface drainage, Running waters, Drainage water.

Identifiers: Liability.

Plaintiff landowners brought an action against defendant power company for damage caused by silting of stream, lake and ponds on plaintiffs' land. Plaintiffs contended that defendant failed to use due care in the clearing of adjacent land, thus causing loose soil, debris and trash to enter the waters on plaintiffs' property. The jury determined that the defendant did not cause or permit any materials to go onto plaintiffs' property which would not have been carried by the normal flow of surface waters from the upper to the lower lands. Plaintiffs appealed, assigning as error the trial court's exclusion of testimony by plaintiffs' witness that it was not necessary for defendant completely to defoliate the adjacent land area. The Court of Appeals of North Carolina held this testimony was not admissible because plaintiffs failed to contend that the defendant power company destroyed all natural vegetation on its right-of-way. (Nursey-Florida)

OBSTRUCTION OF STREAMS OR LAKES BY FYKE NETS OR OTHER DEVICES.
La. Rev. Stat. Ann, Sec. 329 (Supp. 1975). 1 p.

Descriptors: *Administrative agencies, *Louisiana, *Legislation, *Fish, *Fish barriers, Legal aspects, Water law, Conservation, Wildlife, Fish migration, Bodies of water, Water management(Applied), Regulation, Nets, Fish conservation.

Identifiers: *Free passageway(Fish).

This section of the Louisiana revised statutes provides that no person shall obstruct the free passage of fish in any body of water in the State by any means whatsoever. The section shall not apply, however, to water control structures or dams for the retention of water for conservation purposes. In addition, no obstructions shall be set within 500 feet of the mouth of any inlet or pass. Free passageway for fish means a minimum passageway opening of five feet in width extending from the surface to the bottom of the water in the deepest portion of the water. (Nursey-Florida) W76-06089

SOUTH CAROLINA SCENIC RIVERS ACT OF 1974.

SC CODE Ann, sec. 70.45 thru 70.45.16 (Cumm Supp 1974). 5 p. Descriptors: *Wild River Act, Water resources development, South Carolina, *Rivers, *Water conservation, Water law, Water quality control, Conservation, Natural resources, Water Conservation, Natural resources, Water resources, Recreation, Fish, Wildlife conservation, Management, Regulation, Penalties(Legal), Fish conservation, Scenery, Legislation. Identifiers: *South Carolina Water Resources Commission.

The following types of rivers are eligible for inclusion in the South Carolina rivers system: Class I, Natural River Areas; Class II, Pastoral River Areas: and Class III, Partially Developed River Areas. A river qualifying for designation as a scenic river shall possess unique and outstanding scenic, recreational, geologic, fish and wildlife, historic or cultural values in addition to relatively unpolluted waters. Designated scenic rivers shall be permanently managed for the preservation or enhancement of such values. After determining that a river has qualified as a scenic river, the State may accept donations of certain lands adjacent to the river system. All those donating land in fee simple may deduct the value of the property from their state income tax. Finally, the South Carolina Water Resources Commission shall formulate comprehensive water and land use plans for the scenic rivers. (Nursey-Florida)

MARINE CONSERVATION ACT, AMEND-MENTS.

Miss. Gen. Laws, Chap. 572 (1974), 10 p.

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Descriptors: Mississippi, *Legislation, *Aquatic life, *Fishing, *Conservation, Legal aspects, State governments, Federal government, Governmental interrelations, Management, Law enforcement, Penalties(Legal), Water law, Commercial shellfish, Crabs, Oysters, Shrimp, Fish, Beds under water, Commercial fishing, Regulation, Fish management, Water quality, Water quality con-

Identifiers: *Mississippi Marine Conservation Commission, Coastal waters, Coastal zone management.

The Mississippi State legislature has enacted legislation establishing a Marine Conservation Commission with full power to control any matters pertaining to saltwater aquatic life not otherwise delegated to another agency. The executive power of the commission is vested in the Director of Marine Conservation. The Commission is to consist of thirteen members, nine of which will be applied. pointed by the Governor for four year terms. All meetings of the commission will be publicly an-nounced and open to the public. The Commission's powers include: (1) regulation of fishing seasons; (2) setting of size and catch regulations for all types of seafood; (3) acquisition and disposition of oyster shells, seed oysters and other materials necessary to promote the growing of ovsters; and (4) promulgation of enforcement procedures and penalties for violations. The Commission may also enter into agreements which would aid in the propagation, protection and con-servation of Mississippi seafood. (Nursey-Florida) W76-06091

LINGO V. CITY OF JACKSONVILLE (AUTHORITY OF CITY TO PUMP SUBTER-RANEAN WATER). 552 SW2d, 403-406 (Ark 1975), 4 n.

Descriptors: *Underground streams, *Judicial decisions, *Arkansas, *Eminent domain, *Riparian rights, Water distribution(Applied), Water utilization, Withdrawal, Pumping, Water table, Riparian water loss, Water demand, Municipal water, Diversion, Protection, Water levels, Water rights, Water transfer, Utilities, Legal aspects, Reasonable use.

Identifiers: Underground waters, Subterranean

Riparian landowners appealed from judgement of blower court enjoining city appellee from pumping more than a specified amount of water from a subterranean water source. The Arkansas Supreme Court held that the city's removal of the water to a distant point for sale was not necessarily a subject for eminent domain proceedings, and that the riparian landowners were not foreclosed from showing special damages caused by the city's un-reasonable use of the water supply. However, until such a showing is made, the city is a riparian owner exactly the same as appellants, and has an equal right to make reasonable use of the water in-cluding withdrawal for sale. The Court concluded, therefore, that the lower court was correct in restricting the amount of water the city could withdraw to a level that would not damage other riparian landowners. (Parrish-Florida) W76-06092

CALDWELL V. GOLDBERG (DISCHARGE OF EFFLUENT FROM SEWAGE PLANT INTO DRAINAGE DITCH).

NE2d 694-697 (Ohio 1975), 4 p.

Descriptors: *Ohio. *Judicial decisions. *Drainage systems, *Drainage effects, Legal aspects, Water law, State governments, Penalties(Legal), Controlled drainage, Drainage water, Water pollution control, Ditches, Water conveyance, Sewage ef-fluents, Sewage, Sewage disposal, Effluents, Discharge(Water), Public lands, Competing uses. Identifiers: Injunctions(Mandatory), Hazardous substances(Pollution).

Plaintiff agricultural landowners brought action against defendant sewage disposal plant to enjoin defendant from discharging effluent into a ditch built by plaintiffs for agricultural drainage of their land. Defendant contended that the ditch was a public watercourse because it follows the path of natural drainage to the land. Defendant further contended that the injury would be trivial and speculative compared to the expense of constructing the sewage disposal plant. The Supreme Court of Ohio held that the ditch built by plaintiffs was private, not public, since it was not established by action of the county commission nor was it dedicated to public use by plaintiffs. The Court further held that injunctive relief was the proper remedy since the effluent discharge could defeat the very purpose for which the ditch was con-structed and plaintiff would have no adequate remedy at law to recover for such a damage. (Nursey-Florida) W76-06093

OLIVER V. HYLE (TERMINATION OF WATER AND SEWER SERVICES FOR FAILURE TO ARREARAGES DENIAL OF DUE PROCESS).

513 P2d 806-811 (Ore Ct App 1973). 6 p.

Descriptors: *Water users, *Oregon, *Judicial decisions, *Public utilities, *Constitutional law, Legal aspects, Water law, State governments, Local governments, Cities, Water rates, Water supply, Sewerage, Water costs, Water works.

Plaintiff tenants brought a class action against defendant municipal water bureau challenging the constitutionality of defendants' practice of ter-minating the water services of tenants who refused to pay arrearages incurred by prior occupants of the premises. The Plaintiffs contended that the bureau's actions violated the due process and equal protection clauses of the United States and Oregon Constitutions. The Oregon Court of Appeals found the defendant's actions to be unconstitutional holding that, in the absence of a lien or contract, a regulation is unreasonable and void when it seeks to impose a water service obligation on someone other than the one who actually incurred the debt. Thus the water bureau could not constitutionally use the threat of termination of services to compel tenants to pay arrearages in-curred by others. (Nursey-Florida) W76-06094

COASTAL ZONE MANAGEMENT PROGRAM DEVELOPMENT GRANT.

National Oceanic and Atmospheric Administra-tion, Washington, D.C. 40 Fed Reg 16832-35 (1975). 4 p. Identifiers: "Coastal zones, "Coastal Zone

Management Act.

The National Oceanographic and Atmospheric Administration has amended regulations defining the procedures by which states can qualify to receive development grants for development and management of coastal zones under the Coastal Zone Management Act of 1972. The purpose of the development grants is to assist a state in developing a comprehensive management program in its coastal zone. Amendments are made to the regula-tions which provide for methods and procedures for application for the initial management program development grant. Details to be included in the application are specified. Also amended are the regulation provisions pertaining to approval of applications. The regulations pertaining to applica-tions for second and third year grants are also amended. The factors that the Secretary may consider in determining eligibility for second and third year grants are specified. Also specified are the details required to be included in an application for a second or third year grat. (Segall-Florida) W76-06095

ENVIRONMENTAL PROTECTION AGENCY-POULTRY PROCESSING PRODUCTS, PROPOSED PERFORMANCE AND PRETREAT-MENT STANDARDS.

Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-06096

NAVIGABLE WATERS PROCEDURES AND GUIDELINES FOR DISPOSAL OF DREDGED OR FILL MATERIAL.

For primary bibliographic entry see Field 5G.

WATER QUALITY STANDARDS: OREGON (WITHDRAWAL OF PROPOSED RULE MAK-

Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 5G. W76-06098

BARTLEY V. SONE (RIGHT OF INDIVIDUAL TO THE USE OF SPRING WATERS LOCATED WHOLLY ON HIS LAND FOR ANY PURPOSE). 527 SW2d 754-61 (Tex Ct Civ Ap 1975). 8 p.

Descriptors: *Adjacent landowners, *Ditches, *Springs, *Texas, *Groundwater, Groundwater resources, Subsurface waters, Percolating waters, Discharge(Water), Hydrogeology, Overlying proprietor, Running waters, Soil water, Surface-groundwater relationships, Water sources, Adjacent landowners, Judicial decisions, Water law, Irrigation canals, Irrigation ditches, Irrigation practices, Irrigation water, Spring waters.

Plaintiff landowner sought injunctive relief and a declaration of certain rights to use water emanating from a spring upon his property against adjoin-ing landowner. Plaintiff's land contained several springs and these were used to irrigate his property by allowing the water to flow in ditches. Defendant had no springs upon his property but had constructed a ditch to collect the runoff water from plaintiff's ditch. Plaintiff contended he could use this water any way he pleased without having to provide defendant with any water, while defen-dant argued that plaintiff could only use that quan-

Field 6-WATER RESOURCES PLANNING

Group 6E-Water Law and Institutions

tity of water necessary to irrigate on either side of the ditch. The Texas Court of Civil Appeals held that, in the absence of evidence that the flow of the springs had their source in a subterranean stream, it is presumed that the springs on plaintiff's land were of such a character that plaintiff had the right to use their waters for any purpose, either on riparian or nonriparian land, and that the springs were the exclusive property of plaintiff, who had all the rights incident to them that one might have as to any other species of property. (Welch-Florida)

IN RE: MARINE EQUITIES CORP. V. BIGGANE (TIDAL WETLAND ACT CONSTITUTIONAL AS APPLIED TO APPLICATION FOR PERMIT TO FILL UNDER WATER LAND OFF STATEN ISLAND).

373 NYS2d 622-23 (NY Sup Ct 1975). 2 p.

Descriptors: *Administrative decisions, *Permits, *Landfills, *Wetlands, *New York, Water rights, Water law, Legal aspects, Water permits, Constitutional law, Judicial decisions, Legal review, Shore protection, Legislation, Riparian rights, Water policy, Environmental control, Underwater.

Identifiers: *Tidal wetlands.

Plaintiff corporation sought to compel defendant environmental conservation commissioner to issue a permit allowing plaintiff to fill in certain land under water off the shore of Staten Island. Plaintiff also sought to have the Tidal Wetlands Act which prohibits such a land fill declared unconstitutional as applied because it deprived the corporation of property without just compensation. The Supreme Court, Appellate Division, of New York upheld a lower court decision holding that the evidence supported the grounds upon which the commissioner had denied plaintiff's permit application. After a further determination that the Act was not unconstitutional, the court dismissed plaintiff's appeal. (Welch-Florida) W76-06100

UPPER HARMONY DITCH CO. V. CARWIN (TREASURER'S DEED INCAPABLE OF EXTIN-GUISHING DITCH EASEMENT AND WATER RIGHTS UNDER WARRANTY DEED). 539 P2d 1282-85 (Colo. 1975). 4 D.

Descriptors: *Colorado, *Easements, *Ditches, *Maintenance, *Judicial decisions, Trespass, Legal aspects, Land tenure, Real property, Right of way, Water law, Water rights. Identifiers: Abandonment.

Plaintiff corporation brought an action to enjoin defendant landowners from interfering with the maintenance and repair of a ditch owned by the corporation but which transversed the defendants lan 1. The plaintiff claimed an easement for the ditch, contending that the defendants' purchase of the land in question subsequent to the plaintiff's purchase did not extinguish the plaintiff's easement. The trial court granted the injunction. On appeal, the defendants contended that the treasurer's deed by which they had obtained the land created a virgin title which extinguished the plaintiff's prior rights. The defendants also contended that the corporation had abandoned the ditch since no use had been made of it for several years. The Colorado Supreme Court rejected both of these contentions, however, holding that the treasurer's deed did not extinguish the corporation's rights, since an easement is a separate interest in real pro-perty. The court also held that non-use only establishes a presumption of abandonment, and that the plaintiff had entered sufficient evidence to establish that it had not abandoned the ditch. (Hoffman-Florida) W76-06101

STORY V. HEFNER (DEEDS PURPORTING TO DIVIDE LAKE IN HALF INEFFECTIVE TO PROHIBIT USE OF ENTIRE SURFACE FOR RECREATIONAL PURPOSES).
540 P2d 562-70 (Okla. 1975), 9 p.

Descriptors: *Adjacent landowners, *Oklahoma, *Lakes, *Reasonable use, *Easements, Legal aspects, Judicial decisions, Fishing, Skiing, Water sports, Contracts, Recreation, Riparian rights, Littoral, Water policy, Water utilization. Identifiers: Easement by implication, Quitclaim

Plaintiff landowner had owned a lake as tenants in common with the defendant. The plaintiff sub-sequently brought suit to enjoin defendant from using half the of the lake, contending that the defendant had exchanged quitclaim deeds with him dividing the lake into two individually owned tracts. After a decision granting the relief sought, the defendant appealed. The defendant contended that the quitclaim deeds did not give each party ex-clusive right to the use of the lake, since the continued use of the lake was the consideration for the deeds. As proof of this contention, the defendant relied on a separate agreement presented at the trial whereby both parties agreed to allow each other the common use of the lake. In reversing the trial court, the Oklahoma Supreme Court found that the separate agreement created an easement to the entire lake by implication. The court held that the granting of the easement did not have to satisfy the Statute of Frauds, since an easement implied from pre-existing use may be established by parol evidence. Furthermore, a reasonable necessity is sufficient to establish an easement by implication. In this case, the lake was primarily used for fishing and skiing, and thus the use of the entire lake surface was a reasonable necessity. (Hoffman-Florida) W76-06102

WILBER V. WESTERN PROPERTIES (WHETHER AN ARTIFICIALLY ALTERED WATERCOURSE IS A NATURAL OR ARTIFI-CIAL CHANNEL A MATTER OF LAW). 540 P2d 470-74 (Wash. Ct. App. 1975). 5 p.

Descriptors: *Washington, *Drainage systems, *Flooding, *Watercourses(Legal aspects), *Storm drains, Judicial decisions, Artificial watercourses, Ditches, Channels, Penalties(Legal), Water management, Natural streams, Adjacent land owners, Damages. Identifiers: *Abandonment.

Plaintiff apartment house owner brought an action against defendant adjacent land owners seeking damages for the flooding of his apartment house allegedly caused by the negligent operation of the defendants' drainage system. The plaintiff was also seeking an injunction for nuisance abatement. After the trial court awarded a damage verdict and denied injunctive relief, both parties appealed. The defendants contended the trial court erred in refusing to allow the jury to make factual deter-minations as to whether the defendants' open ditch system constituted a natural or an artificially constructed drainage system for the area. They also contended that the jury should have decided if the open ditch was an abandoned method of storm drainage. The Washington Court of Appeals denied both contentions, however, holding that the question of whether an artificially altered watercourse has become a natural channel is a matter of law to be decided by the court. The court also found that the defendants had not introduced sufficient evidence to prove that the ditch was abandoned. As to the plaintiff's cross appeal concerning the denial of injunctive relief, the court found that a careful balancing of the equities involved supported the trial court's decision. (Hoffman-W76-06103

SHAUB V. FIFTH JUDICIAL DISTRICT (ADJUDICATION OF WATER RIGHTS IN MAIN STREAM ALSO AN ADJUDICATION OF RIGHTS IN TRIBUTARIES), 539 P2d 277-80 (Idaho 1975). 4 p.

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Descriptors: *Idaho, *Diversion, *Relative rights, *Stream flow, *Natural flow doctrine, Judicial decisions, Legal review, Legal aspects, Water rights, Riparian rights, Water law, Jurisdiction, Water utilization, Alteration of flow, Water management(Applied). Identifiers: Injunctive relief.

Plaintiff ranch owner had been enjoined in a previous action from diverting more than a specified amount of water from the Mendini Tunnel stream. The plaintiff was later found to have violated the injunction by diverting water from a stream that is a natural tributary of the Mendini Tunnel. Plaintiff then obtained a writ of review contending that the original injunction concerned the Mendini Tunnel. and not the tributary stream; consequently, the ef-fect of the contempt hearing was an improper adjudication of title to the stream. The plaintiff also contended than an injunction operates as an adju-dication only to stay the acts threatened, and cannot prevent acts not prohibited within the injunction. The Supreme Court of Idaho disagreed with both contentions, however, holding that the court had adjudicated only the question of whether the injunction had been violated. Furthermore, the court found that a reasonable construction of the terms of the injunction prohibited the diversion of tributary waters of the Mendini Tunnel for the plaintiff's use. (Hoffman-Florida) W76-06104

BURTON V. DOUGLAS COUNTY (COUNTY LIABILITY FOR FLOOD DAMAGES TO PRO-PERTY CAUSED BY FAULTY ROAD CON-STRUCTION), 539 P24 97-101 (Wash. Ct. App. 1975). 5 p, 1 map.

Descriptors: *Surface drainage, *Washington, *Road construction, *Drainage effects, *Storm runoff, Civil engineering, Drainage area, Drainage systems, Judicial decisions, Surface runoff, Channels, Water spreading, Highway effects, Rainfall, Storm water.

Plaintiff homeowner brought an action against defendant county for damages caused to his home by the construction of a county road. The plaintiff contended that rainfall from a severe rainstorm was channeled and deposited onto his land, causing severe damage to his basement. The trial court dismissed the complaint. In reversing, the appellate court considered two main issues: did the road constitute an artificial channel; and if so, was the county liable regardless of whether the rainstorm was an act of God. The court determined that the road did act as an artificial channel in that a crown in the road caused water which would normally have run across the road to be channeled onto the plaintiff's land. After finding the road to be an artificial channel, the court held that the county was liable regardless of whether the rainstorm was an act of God. The rainstorm would not have damaged the plaintiff's home if it were not for the road; thus, the road was the proximate cause of the damage. (Hoffman-Florida)

STREAM POLLUTION CONTROL BOARD OF STATE OF INDIANA V. UNITED STATES STEEL CORP. (COMMON-LAW PUBLIC NUISANCE ACTION AGAINST STEEL CORP. IN WHICH PRIVATE CITIZEN SOUGHT TO INTERVENE.

512 F2d 1036-1043 (7th Cir. 1975). 8 p.

Descriptors: *Indiana, *Federal Water Pollution Control Act, *Navigable waters, Industrial wastes, Wastes, Environmental effects, Natural resources, Water quality pollutants, Oil pollution, Legislation, Regulation, Judicial decisions, Federal government, Administration, Water quali-ty control, State governments, Jurisdiction, Legal aspects, Supervisory control(Power), Pollution abatement.

abatement. Identifiers: *Federal Water Pollution Control Act Amendments of 1972, Effluent limitations, Public nuisance, Hazardous substances(Pollution).

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Plaintiff-appellant, a private citizen, moved to in-tervene in a public nuisance action brought by a state stream pollution control board against a steel company. The United States District Court for the Northern District of Indiana denied the motion and the plaintiff appealed. His main argument was that the Federal Water Pollution Control Act Amendments of 1972 allowed such intervention. In rejecting this argument, the Seventh Circuit Court of Appeals said that Congress intended this Act to require a step-by-step improvement in quality of discharged effluent, rather than a zig-zag course with total purity demanded forthwith only to be succeeded by various stages of impurity. A private citizen is entitled to intervene if, and only if, the citizen is entitled to intervene if, and only if, the underlying action was commenced to require compliance with a 'standard, limitation, or order' within the meaning of the 1972 Act. Here the complaint of the Board, which sought to abate pollution of the Grand Calumet River, was sufficient to give the District Court jurisdiction to decide whether the Board was entitled to relief under federal common law, but did not bring the action under the 1972 Act. (Parrish-Florida) W76-06106

RESERVE MINING CO. V. ENVIRONMENTAL PROTECTION AGENCY (ACTION BY U. S. AND MINNESOTA TO PREVENT DISCHARGE OF TACONITE TAILINGS INTO WATER OF LAKE SUPERIOR BY PROCESSING COM-

514 F2d, p. 492-542 (Eighth Circuit 1975). 51p.

Descriptors: *Judicial decisions, *Rivers and Harbors Act, *Federal Water Pollution Control Act, *Mine wastes, *Public health, Water pollution, Environmental effects, Mineral industry, Waste dumps, Minnesota, Wisconsin, Michigan, Asbestos, Permits, Legal aspects, Jurisdiction, Lake Superior, Water pollution sources, Waste disposal, Industrial wastes. Identifiers: *Taconite, Tailings, Hazardous sub-

stances(Pollution).

The United States and Minnesota brought an action against defendant mining company to enjoin tion against defendant mining company to enjoin the discharge of taconite tailings into the waters of Lake Superior. Approximately 67,000 tons of tailings are discharged daily into the lake as a slurry. The United States District Court for the District of Minnesota, after hearing conflicting testimony on the health and environmental hazards presented by the discharges, ordered the closing of defendant's Silver Bay facility. Defendant was found to be in violation of Minnesota water quality standards and the Federal Water Polition Control Act. The Fielth Circuit Court of lution Control Act. The Eighth Circuit Court of lation Control Act. The Eighth Circuit Court of Appeals modified the order, giving the defendant a reasonable time to stop discharging wastes into Lake Superior and to find an appropriate land disposal site. Although defendant's discharges were not found to be sufficiently harmful to require an immediate shutdown, the taconite tailings were held to be an illegal discharge of refuse matter in violation of section 407 of the Rivers and Harbors Act. Thus, defendant was warned to use all haste in constructing new facilities to eliminate the discharge of tailings into the ties to eliminate the discharge of tailings into the lake. (Parrish-Florida)

UNITED STATES V. LEWIS (ACTION TO EN-JOIN CONSTRUCTION OF A CAUSEWAY ACROSS A TIDAL MARSH WITHOUT PERMIT REQUIRED UNDER THE RIVERS AND HAR-BORS ACT). 355 F. Supp. 1132-1143 (S.D. Ga. 1973). 12 p.

Descriptors: *Federal jurisdiction, *Tidal marshes, *Georgia, *Judicial decisions, *Rivers and Harbors Act, Navigable waters, Navigation, Water law, Navigable rivers, Riparian rights, Land tenure, Federal government, Regulation, Jurisdiction, Leanagement, Administrative. tion, Legal aspects, Administrative agencies, Legislation, Law enforcement, Non-structural alternatives, Permits, Water rights, Marsh management. Marshes.

Identifiers: Fill permits, Injunctive relief, Navigational servitude, Navigation obstruction

The United States Corps of Engineers brought on action in federal district court to permanently enjoin the defendant landowner from filling certain join the detendant landowner from filling certain tidal marshland and to compel removal of fill and debris already deposited. The defendant had almost completed a causeway across the marshland from his property to a nearby creek. The government contended that the fill was within navigable waters since the affected marshland was adjacent to a navigable creek thus making the defendant in violation of provisions of the Rivers and Harbors Act by failing to obtain a Corps permit. The defen-dant argued that, (1) the creek was not a navigable water, (2) the federal government lacked jurisdiction over the marshland, (3) such regulation constituted a taking of his property without due process of law and (4) the government was estopped to complain because it had full knowledge of his actions yet permitted him to con-tinue. The court held that the marshland was below the original high water marsh subject to in-undation by mean high waters and thus was subject to federal regulatory jurisdictions. The defendant was held in violation of the act and an injunction issued. Further proceedings were ordered regarding the removal of the fill already deposited. (Deckert-Florida)

UNITED STATES V. FLORIDA (PROCEEDING SEEKING DEFINITION OF SEAWARD BOUN-DARY OF SUBMERGED LANDS OF CON-TINENTAL SHELF). 95 S. Ct. 1162-1164, (1975). 3 p.

Descriptors: *Florida, *Boundary disputes, *Gulf of Mexico, *Submerged Lands Act, *Judicial decisions, *Federal-state water rights conflicts, Legal aspects, *Atlantic Ocean, State governments, Federal government, Water law, Legislation boundaries(Property), Beds, Beds under water, Continental shelf, Tidal waters, Aquatic soils. Identifiers: *Florida Bay, Juridicial bay.

Plaintiff federal government sought a decree defining the seaward boundaries of submerged lands of the continental shelf in the Atlantic Ocean and Gulf of Mexico in which Florida has the right to natural resources. The issue was referred to a special master who recommended recognizing a portion of Florida bay as a 'juridicial' bay and drawing 'closing lines' around three groups of islands which comprised the Florida keys. The United States took exceptions to these findings which were made without the benefit of arguments raised by both parties on appeal. The Supreme Court referred these exceptions to the special master for consideration. (Jenkins-Florida)

BUTLER V. BRUNO (DEFLECTION OF SUR-FACE WATERS). 341 A2d 735-742 (RI 1975), 8 p.

Descriptors: *Rhode Island, *Diversion, *Surface drainage, *Reasonable use, *Judicial decisions, Legal aspects, Adjacent landowners, Common law, Legal review, Penalties(Legal), Water law, State governments, Drainage, Surface runoff, Drainage water, Overland flow, Drainage systems, Running waters, Drainage effects, Controlled drainage, Surface waters, Damages. Identifiers: Common enemy rule, Rule of reasonable use.

Plaintiff landowners brought suit against defen-Plaintill landowners orought but against deter-dant adjoining landowner to recover damages resulting from defendant's deflection of surface water from his property onto plaintiffs' premises. The trial court held in favor of defendant based on the 'common-enemy doctrine' under which each landowner has an unlimited privilege to deal with surface waters, without regard to consequences that might be suffered by his neighbors. On appeal, the Supreme Court of Rhode Island held that peal, the Supreme Court of Rhode Island held that the trial court erred in applying the 'Commonenemy doctrine' and that the rule that should have been applied was that of 'reasonable use'. Under this rule the liability of a property owner in draining his land depends on the reasonableness of his actions. This presents a question of fact to be determined upon consideration of the circumstances in each case. Relevant factors to be considerationally deed (1) the presenting the the designer. sidered include: (1) the necessity for the drainage; (2) the degree of care taken to avoid injury to the land receiving the water; (3) the benefit accruing to the land drained; and (4) the availability and feasibility of artificial drainage systems. Since none of these factors had been considered, plaintiff's appeal was sustained and the case remanded. (Nursey-Florida) W76-06110

STATE V CORVALLIS SAND AND GRAVEL CO. (AVULSION: NEWLY SUBMERGED LANDS TITLE IN FORMER OWNER BUT PARAMOUNT NAVIGATIONAL SERVITUDE IN STATE). 526 P2d 469-87 (Ore. Ct. App. 1974). 19 p, 1 map.

Descriptors: *Oregon, *Judicial decisions, *Ownership of beds, *Accretion, *Navigable water, Legal aspects, Water law, Common law, State governments, Water rights, Dredging, Navigable rivers, Navigation, Bodies of water, River beds, Fishing, Running waters. Identifiers: Navigational servitude, Avulsion.

Plaintiff, State of Oregon brought an action in rejectment against defendant gravel company to recover possession of land which was part of the bed of a navigable river. The land in dispute became submerged after the river started to flow through a new channel. Defendant was the owner of the land at the time it became submerged. Plaintiff contended that ownership of the land passed to the State under the law pertaining to accretion. Defendant argued that the change in river flow which submerged the land was sudden and avulsive and therefore, that defendant remained the owner of the land under an exception to the accretion princi-ple. The Court of Appeals of Oregon held that the change in river flow was avulsive; therefore, defendant was the owner of the land. However, since the land was part of the bed of a navigable river, the State held a paramount navigational servitude for the purpose of controlling navigation, fishing and other related public goals. (Nursey-Florida) W76-06111

CITY OF LOS ANGELES V. RICARDS (FLOOD DESTRUCTION OF PRIVATE BRIDGE CAUSES LOSS OF ACCESS AND DEPRECIATION OF PROPERTY VALUE-INVERSE CONDEMNA-515 P2d 585-89 (Cal. 1973). 5 p.

Descriptors: *Real property, *California, *Judicial decisions, *Eminent domain, *Bridges, Legal aspects, Water law, State governments, Local governments, Penalties(Legal), Easements, Construction, Condemnation, Access routes, Flow,

Plaintiff landowner brought an action in inverse condemnation against defendant City of Los An-geles for damage incurred by the destruction of a bridge over which plaintiff held an easement and which constituted the sole access to plaintiff's pro-perty. Plaintiff contended that the bridge was destroyed by waters which were diverted by mu-

Field 6-WATER RESOURCES PLANNING

Group 6E-Water Law and Institutions

nicipal construction at a point upstream from plaintiff's property. Plaintiff remained without access to her property for two years until a new bridge was constructed. The California Supreme Court held that the destruction of the bridge constituted a taking of plaintiff's property for which plaintiff was entitled to compensation. However, the court went on to find that the property was held by plaintiff for speculation and investment and that plaintiff had no intention of selling the property within the two year period required to construct the new bridge. Plaintiff had, therefore. suffered no financial disadvantage and was not entitled to substantial damages for the loss. (Nursey-Florida) W76-06112

LANNING V. STATE HIGHWAY COMMISSION (FLOOD DAMAGE BY DEBRIS COLLECTED IN FRONT OF BRIDGE PIERS). 515 P2d 1355-59 (Ore. Ct App 1973). 5 p

Descriptors: *Oregon, *Piers, *Negligence, *Flood damage, *Bridges, Legal aspects, Water law, State governments, Penalties(Legal), Struc-tures, Maintenance, Bodies of water, Judicial decisions, Floods, Real property. Identifiers: Sovereign immunity, Liability(Legal),

Proximate causation.

Plaintiffs landowners brought an action against de-fendant State of Oregon for damage caused to plaintiffs' land by flooding. Plaintiffs contended that defendant was negligent in failing to remove accumulated debris from state bridge piers. This accumulated debris caused the flooding of plaintiff's land. The State argued that the decision to remove or not remove the debris was a discretionary state function for which the state was immune from liability. The Court of Appeals of Oregon held that maintenance of the piers was not a discretionary function. The state had a duty to maintain its bridge piers and was therefore liable to plaintiffs for failing to remove the debris which caused the flood damage to plaintiffs' land. (Nursey-Florida) W76-06113

GOOSE CREEK HUNTING CLUB, INC. V. UNITED STATES (DAMAGES FOR GOVERN-MENT'S TAKING OF PERMANENT FLOWAGE

EASEMENT), 518 F2d 579-84 (Ct C1 1975), 6 p.

Descriptors: United States, *Judicial decisions, *Eminent domain, *Navigable waters, Legal aspects, Water law, Constitutional law, Federal government, Navigation, Rivers, River beds, Bodies of water, Non-navigable waters, Water

Identifiers: *Navigational servitude

Plaintiff landowner brought an action against the United States Government for an alleged taking of plaintiff's property adjacent to a non-navigable creek. Plaintiff contended that the government's action in raising the minimum water level in a nearby navigable river raised the minimum level in the non-navigable creek adjacent to plaintiff's land thereby flooding the land. The Court of Claims held that, although the government is not liable for water damage caused to land within the bed of a navigable river, when that damage results from improvements of navigable waters, the government is liable for damage to land outside the bed of the river. Since plaintiff's land bordering on a non-navigable creek which flowed into a navigable river was not within the bed of the navigable river, plaintiff was entitled to recovery. (Nursey Florida) W76-06114

COMMONWEALTH, DEPARTMENT OF NATU-RAL RESOURCES V. WESTMORELAND-FAYETTE MUNICIPAL SEWAGE AUTHORITY (APPEAL BY MUNICIPAL ENTITY FROM ORDER TO CURB DISCHARGE OF UNTREATED SEWAGE INTO WATERS OF PENNSYLVANIA.,
336 A2d 704-706 (Commonwealth Ct Penn., 1975).

Descriptors: *Pennsylvania, *Municipal wastes, *Sewage disposal, *Sewage treatment, Judicial decisions, Regulation, State jurisdiction, Governmental interrelations, Local governments, Water quality standards, Administration, Constitutional law, Proprietary powers, Streams, Legal aspects, Water law

Identifiers: *Clean Streams Law, *Environmental Hearing Board, *Due process, Municipal property

The Pennsylvania Department of Environmental Resources (DER) issued orders to four municipal entities directing them to abate the pollution caused by the discharge of untreated and inadequately treated sewage into waters of the Com-monwealth in violation of the Clean Streams Law. An appeal of this order made to the Environmental Hearing Board (EHB) was dismissed. Con-sequently, the municipal entities appealed the EHB decision, contending that a denial of the appellants' due process rights would result from en-forcement of the DER orders. Appellants conceded that municipalities have generally been denied the right to assert their due process protections against actions instituted by the sovereign. However, appellants urged that this concept should not be applicable where the municipal pro-perty rights 'appropriated' by the state were rights in property used for proprietary, not governmental, purposes. The court relied on a U.S. Supreme Court case that found the governmen-tal/proprietary dichotomy was not relevant in the context of pure state/municipality interactions. Consequently, since this case involved such a pure interaction, the court affirmed the pollution abatement order. (Hoffman-Florida) W76-06115

6F. Nonstructural Alternatives

COPING WITH FLOOD HAZARD IN NEW BRAUNFELS AND SEGUIN, TEXAS, Southern Illinois Univ., Carbondale. Dept. of

Geography.

D. D. Baumann, and N. A. Simkowski. In: 'Reservoir Impact Study,' p 3. 1.i-3,3.37, November 1974. 102 p. 4 fig, 21 tab, 61 ref.

Descriptors: *Flood protection, *Flood plain in-surance, Adoption of practices, Attitudes, Risks, Surveys, Land use, Local governments, Legal aspects, Property values, Legislation, *Texas. Identifiers: *Canyon Reservoir(Tex), New Braun-fels(Tex), Seguin(Tex), Guadalupe River(Tex).

The role that Canyon Dam on the Guadalupe River may have had in the adoption of flood damagereducing adjustments at New Braunfels and Seguin, Texas, on the individual and community level, and those factors related to the decisions to purchase flood insurance on an individual basis are identified by evaluating individuals' conative responses. In order to achieve the desired action a program should be designed that would make an appeal based upon cultivating an individual's sense of efficacy in coping with the hazard. The problems involved in how and with what difficulties community decisions are reached in the for-mulation and implementation of flood-plain regulations were analyzed from the locus of the structure of community power and on the individual characteristics of those who exert influence over the decision. Regulation proposals seem to encounter general public apathy and lack of concern. Most organized participation from the private sector is in the opposition. City officials lack a welldefined methodology to determine a satisfactory scheme and appraise the social and economic consequences ordinances will have on the community. The levels of responsibility and participation of federal, local, and citizens are identified, their roles evaluated, and recommendations for improvements are suggested. (See also W76-04501) (Auen-Wisconsin). W76-05502

FLOOD HAZARD ANALYSES: BUF RIVER, AMHERST COUNTY, VIRGINIA. Soil Conservation Service, Richmond, Va. For primary bibliographic entry see Field 4A W76-05643

FLOOD HAZARD ANALYSES: BLACKS RUN-COOKS CREEK, ROCKINGHAM COUNTY AND HARRISONBURG, VIRGINIA. Soil Conservation Service, Richmond, Va For primary bibliographic entry see Field 4A. W76-05644

FLOOD PLAIN INFORMATION: ILLINOIS AND MICHIGAN CANAL, ROCK RUN CREEK, THORNE CREEK, JOLIET, ILLINOIS. Army Engineer District, Chicago, Ill. For primary bibliographic entry see Field 4A. W76-05645

SPECIAL FLOOD HAZARD INFORMATION REPORT: HOWELL CREEK BASIN LAKES, ORANGE COUNTY, FLORIDA, Army Engineer District, Jacksonville, Fla. For primary bibliographic entry see Field 4A. W76-05646

FLOOD PLAIN INFORMATION: COASTAL AREAS, LEVY COUNTY, FLORIDA.
Army Engineer District, Jacksonville, Fla For primary bibliographic entry see Field 4A. W76-05647

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FLOOD PLAIN INFORMATION: LITTLE MC-MULLEN CREEK, JESUP, GEORGIA. Army Engineer District, Savannah, Ga. For primary bibliographic entry see Field 4A. W76-05648

CRITERIA FOR EVALUATION OF SOCIAL IM-PACTS OF FLOOD MANAGEMENT ALTERNA-

Institute of Public Administration, New York. For primary bibliographic entry see Field 6B. W76-05653

FLOOD LOSS MANAGEMENT IN DEVELOP-ING COUNTRIES: A MODEL FOR IDENTIFY-ING APPROPRIATE STRATEGIES, Victoria Univ. (British Columbia). Dept. of Geog-

For primary bibliographic entry see Field 6A. W76-05761

MONETARY VALUES OF LIFE AND HEALTH. Tennessee Valley Authority, Knoxville. Flood Control Branch. B. Buehler.

Descriptors: *Mortality, *Evaluation, *Project benefits, *Measurement, Safety, Public health, Social values, Income, Risks, Dams, Flood con-

Property damage prevention, though considerable, rioperty damage prevention, though considerable, falls far short of justifying the high cost of flood control projects. Preventing flood-caused death and injury would be the principal project benefit. To substantiate this idea, the preventable lost lifestream of earnings is used to measure human worth to quantify this benefit. The technique advocated evaluates human worth on the worth of an individual to his family in the next-of-kin concept and his/her worth to society in a broader concept. Both the societal and next-of-kin concepts are examined and the next-of-kin evaluation is demonstrated. strated. Three examples show a practical method of computing human worth: (1) For a typical 33-yr old married male, (2) for a 33-yr old housewife (including the use of substitute services), and, (3) for a 12-yr old male child which includes subsistence and educational costs prior to gainful employment. Illustrated also is the strong reducing in-fluence of discounting distant future earnings to present worth. A case study of a resort city, comprised of 26 human groups is summarized showing that their weighted composite values round out to \$166,000 for value lost due to death (in 1971 dollars) and \$258,000 value lost due to permanent disability. (Auen-Wisconsin) W76-05812

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lost man REGIONAL WATER EXCHANGE FOR DROUGHT ALLEVIATION,
Colorado State Univ., Fort Collins. Hydrology and

Water Resources Program. For primary bibliographic entry see Field 4A. W76-05819

BENEFIT AND COST AS HYDROLOGICAL FORECASTS, ANALYSIS OF World Meteorological Organization, Geneva

(Switzerland). For primary bibliographic entry see Field 6B. W76-05823

CERTAIN LAND USE REGULATIONS TO PRO-TECT FROM DANGER OF FLOODING. Nags Head Town Council, Nags Head, N.C. Land Use Ordinance (1975) 3 p.

Descriptors: *North Carolina, *Legislation, *Flood protection, *Flood plain zoning, *Building codes, Legal aspects, Local governments, Water law, Construction, Floods, Flood control, Drainage systems, Water supply, Flood damage, Flood plains, Floodways, Floodproofing, Regula-tion, Water management(Applied), Maximum probable flood, Flood data, Land, Land use, Land

development.
Identifiers: *National Flood Insurance Program.

The town of Nags Head, North Carolina has adopted an ordinance for the protection of structures and inhabitants from the danger of flooding, representative provisions of which include: (1) all new construction of residential structures or substantial improvements of existing residential structures will have the lowest floor elevated to at least the applicable level of the 100-year flood or 9 feet mean sea level; (2) all new construction of non-residential structures or substantial improvement of existing non-residential structures will have the lowest floor elevated to at least the applicable level of the 100-year flood or 9 feet mean sea level, or will be floodproofed up to the applicable level of the 100-year flood; (3) new constructions or substantial improvements on land in 'Coastal High Hazard Areas' below the 100-year flood level will be elevated on adequately anchored piles to a lowest floor level at or above the applicable 100-year flood level or 9 feet mean sea level; (4) all building permit applications for new construction or substantial improvements within 'Special Flood Hazard Areas' will be reviewed to assure that the proposed construction will minimize flood damage; and (5) all new or replacement sewage or water supply systems within 'Special Flood Hazard Areas' shalll be designed and located to minimize infiltration of flood waters and discharges into flood waters. These and other provisions are designed to enable Nags Head to participate in the Federal Flood Insurance Program. (Nursey-Florida) W76-06059

SUGGESTED PROVISIONS TO BE USED IN ZONING ORDINANCES FOR COMPLIANCE WITH SECTIONS 1910.3(C) OF THE NATIONAL FLOOD INSURANCE PROGRAM. (1974), 10 p.

Descriptors: *Flood plain zoning, *Land use, *Land classification, *Non-structural alternatives, *Flood proofing, Public health, Beneficial use, Floodways, Administration, Flood protection, Legislation, Maps, Construction, Permits, Reasonable use, Penalties(Legal), Legal aspects, Zoning. Identifiers: *National Flood Insurance Program

To prevent unnecessary damage from flood waters, this ordinance would require that all flood plain lands be zoned as either a floodway district or flood fringe district. Land uses in the floodway district would generally be limited to those having a low flood damage potential. Special exemptions could be obtained for other specified uses, however, provided that all floodproofing provisions in other codes were met. Typical uses which could qualify for these exemptions include: streets; bridges; water related uses; and structures accessory to low flood damage potential uses. Also suggested are a list of factors which should be considered by the zoning board when considering ap-plications for exemptions, including: possible danger to life or property; public importance of the proposed land use; availability of alternative sites; and location of the land. In contrast to the extenand location of the land. In contrast to the exten-sive regulation of flooding districts, flood fringe districts will generally be zoned to allow most types of land uses, including the construction of buildings and similar structures. To implement this land use zoning, several general provisions are suggested including: establishment of the zoning maps; interpretation of district boundaries; warnings and disclaimers of liability; and applicability of zoning ordinances. (Hoffman-Florida) W76-06060

COASTAL ZONE MANAGEMENT PROGRAM DEVELOPMENT GRANT.

National Oceanic and Atmospheric Administration, Washington, D.C. For primary bibliographic entry see Field 6E. W76-06095

6G. Ecologic Impact Of Water Development

SOCIOLOGICAL ANALYSIS OF DAM IMPACT: A STUDY OF TWENTY-TWO LARGE DAMS IN TEXAS.

Texas A and M Univ., College Station. Dept. of Sociology and Anthropology.
For primary bibliographic entry see Field 6B. W76-05501

THE IMPACT OF CANYON DAM AND RESER-

VOIR ON WILDLIFE, Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.

B. W. Cain. 'Reservoir Impact Study,' p. 5.i-5.23, November 1974. 6 tab, 11 ref.

Descriptors: *Reservoirs, *Wildlife, Texas, Birds, Mammals, Reptiles, Fish, Post impoundment, Sur-Identifiers: Reservoir(Texas).

*Canyon Guadalupe River(Texas)

To determine the impact of Canyon Reservoir, Texas, on the wildlife, a biological survey of the river bottom above and below the impoundment indicated that the reservoir and the accompanying land-use changes reduced the bird population from 53 to 31 species; the higher number was observed in the adjacent recreational parks. White-tail deer were numerous in the ranch lands surrounding the

reservoir, parks, and residential areas but their numbers around the reservoir were reduced. Most of the small fur-bearing mammals identified are nocturnal and thus are less affected by human activity. The poisonous snakes will probably be reduced as people are quick to kill them. The toads reduced as people are quick to kill them. The toads and frogs may prosper with reduced predation. The reservoir apparently affects the distribution and abundance of fish species. The rainbow trout has been introduced and their survival and reproduction have good prognosis. Bass, crappie, and catfish have apparently suffered no ill effects, but fish require the results are to the survival and th but fish species that require moving water were af-fected. The group of animals least affected by the reservoir construction appear to be mammals and the most affected group is fish. All species identified are listed. (See also W76-04501) (Auen-

ENVIRONMENTAL CONSIDERATIONS IN RIVER BASIN PLANNING AND DECISION

Arizona Univ., Tucson, Inst. of Renewable Natural Resources

For primary bibliographic entry see Field 4A. W76-05510

PRECIPITATION MANAGEMENT RECLAMATION OF OVERGRAZED AREAS IN ARID AND SEMI-ARID REGIONS,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 2B. W76-05603

HOW TO GUIDE GROWTH IN SOUTHEAST-ERN NEW ENGLAND, PARTS I, II AND IV OF THE DRAFT REPORT.

New England River Basins Commission, Boston, Mass. Southeastern New England Study. Review Draft, May 1975. 294 p, 3 fig, 33 tab, 17

Descriptors: *Planning, *Water supply, *Water quality, *Land use, *Environmental effects, *Regional economics, New England, Massachusetts, River Basin Commissions.

Identifiers: *Environmental impact statement, Boston metropolitan area, Cape Cod(MA), Southeastern New England, *New England River Basins Commission

This is a public review draft which is subject to change in scope and detail. Its purpose is to identi-fy and recommend actions by government and private interests to secure for the people of the region a balance of conservation and development. It details the natural resource base, including limitations and capabilities, future demands on resources, and a management program. Three key findings: enhancing the environment will enhance the region's economy because it is the environment which attracts service activities which will surpass manufacturing in the region before 1990; anticipated growth can be accommodated but must be guided to be efficient; and existing local and state institutions are capable of guiding growth. Numerous recommendations are made concerning several areas: guiding growth, water supply, water quality, outdoor recreation, marine management, flooding, unwelcome facilities, and resource protection. Recommendations are ranked into 4 categories. Emphasis is on striking a balance between growth and protection of the environment, and on achievable goals. In water supply the goal is to meet municipal needs for adequate supplies of fresh water in the most economically feasible and environments. ble and environmentally sound manner. With regard to unwelcome facilities the objective is to provide such vital services as power, fuel, construction materials and solid waste disposal in a manner which supports economic growth but which minimizes environmental impacts. Recom-mendations are varied to respond to individual

Field 6-WATER RESOURCES PLANNING

Group 6G-Ecologic Impact Of Water Development

needs; they include planning proposals, management programs, construction projects, surveys, tax proposals, licensing schemes, information dis-semination, and zoning proposals. (Smith-North Carolina) W76-05649

HANLON CREEK ECOLOGICAL STUDY, PHASE B.
Guelph Univ. (Ontario). Centre for Resources

Volume 1. April 1972. 71 p, 1 fig, 12 maps, 1 tab.

Descriptors: *Watershed management, *River basin development, *Urbanization, *Recreation, *Land use, Groundwater, Water table, *Ecology, Planning, Environment, Habitates, City planning, Runoff, Wildlife conservation, Storm drains, Storm runoff, *Canada.
Identifiers: *Hanlon Creek(Ontario-Canada), City

of Guelph(Ontario), Open space.

This study depicts the terrestrial and aquatic environment of Hanlon Creek and its watershed near the City of Guelph, Ontario. It was undertaken to aid planning and to insure that future options are not closed off prematurely. While this watershed is of high quality, neither prohibiting urban development nor allowing total urbanization is justified. Recommendations are made concerning municipal development and change: drainage systems, sediment control, roof drainage, toxic substances; stream biology considerations; maintain the watertable, preserve wooded areas, reforest slopes; terrestrial wildlife and vegetation; landscape quality control including woodlands, in-stitutional, commercial, residential uses; and social concerns which involve open space, recreation centers, bicycle paths, youth centers and out-door entertainment. Analysis of data collected through a year of study is given with maps which show many environmental considerations. These include water table depths, depth of organic matter, slope, limitations of urban development, underground utilities, susceptibility to erosion, recreation areas, and location of lagoons for renovation of storm sewer waters. The maps are drawn at small scale. Exact conditions of a site must be determined by survey. The study con-cludes with alternative development policies which are aimed at working with natural systems. The policies can take either a conservation emphasis, a recreation emphasis or a development emphasis. Each has advantages and disadvantages in terms of environmental quality, cost, access, etc. No final decision can yet be made but this study is a beginning to appropriate planning for the watershed area. (Smith - North Carolina) W76-05650

STRUCTURING COMMUNICATIONS GRAMS FOR PUBLIC PARTICIPATION IN WATER RESOURCES PLANNING.

Utah State Univ., Logan. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 6B.

A STUDY OF PROSPECTIVE WATER POLLU TION CONTROL ACTIVITIES FOR THE OHIO RIVER VALLEY WATER SANITATION COM-MISSION (ORSANCO),

Wendell Associates, McLean, Va. For primary bibliographic entry see Field 5G. W76-05654

MANAGEMENT OF ENVIRONMENTAL QUALITY: OBSERVATIONS ON RECENT EX-PERIENCE IN THE UNITED STATES AND THE UNITED KINGDOM,

North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 5G.
W76-05659

LAKE AND SHORE ICE CONDITIONS ON SOUTHEASTERN LAKE MICHIGAN IN THE VICINITY OF THE DONALD C. COOK NUCLEAR PLANT: WINTER 1973-74, Univ., Ann Arbor. Great Lakes Research Div.

For primary bibliographic entry see Field 2C. W76-05664

MEASURING AND MINIMIZING THE SOCIAL COST OF ENVIRONMENTAL POLLUTION, Tennessee Univ., Knoxville. Center for Business and Economic Research. For primary bibliographic entry see Field 5G. W76-05824

A TECHNIQUE FOR ENVIRONMENTAL DECI-SION MAKING USING QUANTIFIED SOCIAL AND AESTHETIC VALUES, Battelle-Pacific Northwest Labs., Richland,

For primary bibliographic entry see Field 5G.

W76-05825

WILLINGNESS TO PAY AS A BEHAVIOURIAL CRITERION FOR ENVIRONMENTAL DECI-SION-MAKING,

Waterloo Univ. (Ontario). Dept. of Man-Environment Studies

For primary bibliographic entry see Field 5G.

ENVIRONMENTAL IMPACT ASSESSMENT AS AN INSTRUMENT OF PUBLIC POLICY FOR CONTROLLING ECONOMIC GROWTH. Waterloo Univ. (Ontario). Dept. of Man-Environ-

ment Studies D. W. Fischer International Journal of Environmental Studies,

Vol. 6, No. 4, p. 233-242, 1974. 43 ref.

Descriptors: *Decision making, *Project planning, *Economic impact, *Environmental effects, Evaluation, Effects, Project purposes, Federal project policy, Benefits, Costs. Identifiers: *Economic growth, Environmental

impact assessment.

A complete environmental impact assessment system should consist of identification of planned and induced economic activities and affected environmental elements; an evaluation of initial and subsequent impacts; and, management of beneficial or adverse environmental impacts generated by both planned and induced activities over time. The results of a required assessment system would have considerable consequences for economic growth. As a control instrument it will, no doubt, dampen the economic growth rate by modifying, or curtailing altogether, projects on which growth depends. The main thrust of environmental assessment as a control instrument is its wide applicability to all impacts of economic activities, public and private, and to the impacts of all economic materials, whether the materials are inputs, outputs, or wastes. In this wide role, environmental assess-ment provides an umbrella for complementary control instruments such as regulations, stan-dards, subsidies, taxes and effluent charges, prohibitions, and appropriations. Assessment provides an information base for possible employment of other control measures to help mitigate the impact of growth activities. For example, should an assessment reveal an adverse impact such as pollutant emissions, an effluent charge could be set to reduce or eliminate them. Two disadvantages associated with environmental assessment include reduction in investment and innovation, and difficulty in achieving an optimum. (Slattery-Wisconsin). W76-05828

RELATION OF WATER LEVEL AND FISH AVAILABILITY TO WOOD STORK REPRODUCTION IN THE SOUTHERN EVER-GLADES, FLORIDA, Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 2I. W76-05850

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RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT -ECOLOGY, JANUARY-DECEMBER 1974. Argonne National Lab., Ill. Radiological and Environmental Research Div.
For primary bibliographic entry see Field 5C. W76-05879

SOUTH DAKOTA ENVIRONMENTAL POLICY For primary bibliographic entry see Field 5G.

7. RESOURCES DATA

7A. Network Design

DIVER BASIN MODELS AND THEIR APPLICA-TION WITH SCARCITY OF DATA. World Meteorological Organization, Geneva (Switzerland) For primary bibliographic entry see Field 4A. W76-05516

CORRECTION OF BIAS IN THE ESTIMATION OF THE COEFFICIENT OF SKEWNESS, Institut National de la Recherche Scientifique, Rimouski (Quebec). For primary bibliographic entry see Field 2E. W76-05910

PUMPING-TEST ANALYSIS USING A DISCRETE TIME-DISCRETE SPACE NUMERICAL METHOD. Birmingham Univ. (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 4B.

W76-05913

7B. Data Acquisition

LINE MOTION AND WATER CURRENT DISC SENSOR.

Office of the Secretary (Navy), Washington, D. C. (Assignee).

M. L. Greene, and G. J. Moss.

M. L. Oreene, and G.J. Moss. U. S. Patent No. 3,929,015, 3 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2040, December 30, 1975.

*Patents, *Currents rs, *Instrumentation, *Currents(Water), Descriptors: meters, Current Velocity, Monitoring, Ocean currents. Identifiers: Mooring lines, Cable strum

The device may be secured in the water for determining current flow or frequency and amplitude of strumming mooring lines. The device includes an aluminum tubular member having parallel electrical lines extending along the length of an inside of the tubular member. A ring type magnetic follower on the inside of the tubular member having a slidewire in contact with the parallel wires follows a magnetic ring on the outside of and surrounding the tubular member and operates as a potentiome ter. The magnetic ring is mounted on a neutrally buoyant slidable disc which is operative between two opposing stainless steel nonmagnetic springs. Current flow or a force against the disc moves the disc along the length of the tubular member against one of the springs. The magnetic follower follows the disc thereby shortening or lengthening the ef-

fective resistance length of the wires within the tubular member. The resistance wires are connected electrically with a recorder or other instruments to indicate the movement of the disc. The displacement of the disc. The displacement of the disc is proportional to the square of the velocity component in the direction of movement. (Sinha - OEIS)
W76-05539

FLOWMETER FOR AN OPEN AQUEDUCT. Yamatake-Honeywell Co., Ltd., Tokyo (Japan).

K. Takeuchi, and R. Matsumoto.

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U. S. Patent No. 3,929,016, 3 p. 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2041, December 30, 1975.

Descriptors: *Patents, Channels, *Open channels, *Water conveyance, *Flow measurement, *Flowmeters, Water measurement, Flow control, Gates

Identifiers: *Electromagnetic flowmeters.

A flowmeter arrangement measures the flow rate of water flowing in an open aqueduct. A dam gate is positioned to be raised or lowered into a sump portion of the aqueduct. The sump has a fluid depth greater than the aqueduct. The lower central portion of the gate carries an electromagnetic flowmeter transducer. When the dam gate, carrying the electromagnetic flow transducer, is lowered to operating position, the flow of water is blocked by the gate. The depth of the sump is such that so long as there is fluid flowing in the aqueduct, the sump will be full and the electromagnetic transducer will be submerged to a depth were the bore of the transducer will be completely filled. With the transducer thus submerged in the sump, all of the fluid flowing in the aqueduct flows through the transducer where the flow rate is sensed, and a corresponding signal transmitted to the supporting electronic circuitry. (Sinha - OEIS) W76-05540

COMPARATIVE EFFECTIVENESS OF THE STANDARD SURBER SAMPLER AND A HYDRAULIC MODIFICATION FOR ESTIMAT-ING BOTTOM FAUNA POPULATIONS, Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. W. R. Meehan, and S. T. Elliott. The Progressive Fish-Culturist, Vol 36, No 1, p 17-

19. January, 1974, 1 tab, 10 ref.

Descriptors: *Benthic fauna, *Bottom sampling, Reliability, Variability, Streams, *Alaska, Sam-pling, Analytical techniques. Identifiers: Surber samplers.

The effectiveness of a hydraulic modification of the Surber sampler for assessing benthic fauna was evaluated by comparing it with the standard Surber sampler. Sampling was done in two streams in southeast Alaska by taking a sample with the hydraulic unit adjacent to one taken with the standard Surber. Several of these paired samples were taken from different stream bottom types. Analyses failed to show any significant differences between the two techniques in numbers, weight, or species composition of the bottom fauna obtained. (Forest Service). W76-05613

THE APPLICATION OF SEQUENTIAL ESTI-MATION METHODS TO COUNTS OF PHYTOPLANKTON,

Comitato Nazionale per l'Energie Nucleare, Rome (Italy). Technological Lab. For primary bibliographic entry see Field 5A. W76-05622

DESIGN AND RESULTS OF COMPARATIVE TESTS OF A RAINFALL RECORDER OPERATING FOR A WEEK (WRR),

ING FOR A WELL (WAR), N. A. Zykov. Soviet Hydrology, Selected Papers, No. 6, p 500-503, 1973. I fig, 3 tab. Translated from Trudy Gos-sudarstvennogo Gidrologicheskogo Instituta, No. 207, p 127-131, 1973.

Descriptors: *Rain gages, *Rainfall,
*Instrumentation. *Measurement, Rainfall intensi-Descriptors: ty, Rain, Precipitation(Atmospheric), Rates, Meteorology. Identifiers: *USSR.

Detailed coverage of large unpopulated areas with observations by precipitation gages and pluviographs is difficult and there are no Soviet rain recorders that operate automatically for a long time. Therefore it is very important to develop an instrument for measuring rainfall depth and intensity that would operate automatically for a long period. The design of such an instrument (WRR) was developed and tested in the experimental areas of the Valdai Hydrologic Scientific Research Laboratory in 1971. The design of the WRR instru-ment and comparison tests of its readings with those of a standard instrument were described. The results of the comparative tests lead to the conclusion that the WRR measures the amount of precipitation during the warm period somewhat more accurately than the precipitation gage and the rainfall totalizer. The rainfall intensity recording accuracy of this instrument is 0.01 mm/min lower than that of the pluviograph. (Sims-ISWS)

A SPECTRAL LIGHT ABSORPTION METER FOR MEASUREMENTS IN THE SEA, Copenhagen Univ., Denmark. Inst. of Physical

Oceanography. N. Hojersley.

Limnology and Oceanography, Vol. 20, No. 6, p 1024-1034, November 1975. 10 fig, 4 tab, 19 ref.

Descriptors: *Optical properties, *Light intensity, *Instrumentation, *Analytical techniques, Light, Opacity, Light penetration, Reflectance, Aquatic environment, Physical properties, Absorption, Measurement, Sea water, Testing procedures, Onsite tests, Water measurement, Oceans.

Identifiers: *Light absorption meter, Irradiance, *Denmark, *Spectral absorption meters, Absorption coefficients, Light scattering, Light transmission, Vector irradiance, Scalar irradiance, Fluorescence, Chemical energy, Fluorescent light, Absorption meter.

The light absorption coefficient of a medium such as seawater is an inherent optical property that can be determined in absolute values by means of the uncalibrated in situ light absorption meter described here. The method was based on the assumptions that the optical conditions remain steady within the measuring period, that the horizontal divergence of the vector equals zero. and that the natural fluorescent light energy within the visible part of the spectrum can be ignored. The light absorption meter measures simultaneously the sum and the difference of the scalar and vector irradiance. (Henley-ISWS)

ON RADAR-RAINGAGE COMPARISON, Quebec Univ., Montreal. Dept. of Physics. For primary bibliographic entry see Field 2B.

AN ASSESSMENT OF AUTOMATIC SEWER FLOW SAMPLERS - 1975, EG and G Washington Analytical Services Center,

Inc., Rockville, Md. For primary bibliographic entry see Field 5D. W76-05864 SEWER FLOW MEASUREMENT - A STATE-OF-THE-ART ASSESSMENT, EG and G Washington Analytical Services Center, Inc., Rockville, Md.

For primary bibliographic entry see Field 5D. W76-05865

COMPILATION OF METHODOLOGY USED FOR MEASURING POLLUTION PARAMETERS OF SANITARY LANDFILL LEACHATE, Illinois Univ. at Urbana-Champaign. Dept. of Civil

Engineering. For primary bibliographic entry see Field 5A W76-05869

DEVELOPMENTS IN UNDERWARDIOTELEMETRY AND PRELIMIN FISH TRACKING IN THERMAL PLUMES, UNDERWATER PRELIMINARY Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.

For primary bibliographic entry see Field 5C. W76-05893

CHARACTERISTICS OF TEMPERATURE-SEN-SITIVE FISH TAGS USED IN 1974,

Argonne National Lab., Argonne, Ill. Radiological and Environmental Research Div.
For primary bibliographic entry see Field 5C.
W76-05897

NUCLEAR TECHNIQUES IN HYDROLOGY-CURRENT STATUS AND PROSPECTIVE USES. National Academy of Sciences, Washington, D.C.: National Committee for the International Hydrological Decade, Washington, D.C. For primary bibliographic entry see Field 5A.

ESTIMATE OF THE RATE OF TURBULENT MIXING OF THE FLUID IN WIND-DRIVEN CURRENTS FROM THE RESULTS OF MOV-ING AND STILL PARTICLE PHOTOGRAPHY, For primary bibliographic entry see Field 8B. W76-05932

PORTABLE WATER SAMPLING APPARATUS, Universal Oil Products Co., Des Plaines, Ill.

(Assignee).
J. L. Mogg, and R. E. Paulson.
U.S. Patent No. 3,930,754, 3 p, 3 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 942, No 1, p 353, January 6, 1976.

Descriptors: *Patents, *Water sampling, *Water wells, *Observation wells, *Aquifer testing, Draw-down, Samplers, Water pollution, Equipment, Pollutant identification. Identifiers: Portable equipment.

Portable, self powered water pumping apparatus for use in sampling water in remotely located wells comprises a wheeled hose reel cart which supports a long length of plastic hose or tubing. The tubing has a small diameter length of inner tubing telescoped inside itself throughout most of its length. The inner tubing passes through the wall of the outer tubing near the upper end and is connected to a pressurized cylinder of gas such as a standard 14 oz. propane gas cylinder. When the lower ends of the tubes are well submerged beneath the water level in a well, admission of gas to the inner tube at its upper end will force water up through an annular space between the tubes and out the upper end of the outer tube where it can be collected. A channeled plug at the bottom of the tubes prevents the tubes from collapsing, helps to keep them straight and together as they are lowered into the well and provides partial support for a weight hanging from the bottom of the tubes. (Sinha-OEIS)

Field 7-RESOURCES DATA

Group 7B-Data Acquisition

WATER LEVEL GAUGE, Department of the Navy, Washington, D.C. Office of the Secretary. N. H. Rector, and R. G. Fredericks.

U.S. Patent No. 3,933,042, 3 p, 8 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 942, No 3, p 1149, January 20, 1976.

Descriptors: *Patents, *Water levels, *Water level fluctuations, *Water level recorders,
*Instrumentation, Bodies of water, Height, Tidal Identifiers: Stilling wells.

A water level gauge is described which is used to determine the average level of water in a body of water such as rivers, lakes and oceans under varying ambient conditions. The liquid level gauge in-cludes a stilling well, a pipe tower for retaining the stilling well at a fixed position in relationship to the water level to be measured, a capacitance probe inside the stilling well, means for admitting liquid into the stilling well, means for admitting liquid inside the stilling well, means for admitting inquidinto the stilling well at a predetermined rate and electronic circuitry for placing a signal on the probe. The probe consists of a probe which has dielectric coating and a second probe retained in a predetermined spaced position from the first. An electric signal applied to the probes is measured to relate the change in capcitance between the first and second probes depending upon the amount of liquid in the stilling well. (Sinha-OEIS)

APPLICATION OF INFRARED SPECTROSCO-PY TO ERODIBILITY STUDIES OF THE SOIL, Allahabad Univ. (India). Dept. of Chemistry. For primary bibliographic entry see Field 2J. W76-06140

7C. Evaluation, Processing and Publication

RESERVOIR MANAGEMENT VIA RELIABILI-

TY PROGRAMMING, Politecnico di Milano (Italy). Istituto di Elettrotecnica ed Elettronica.

For primary bibliographic entry see Field 4A. W76-05508

THE OUT-OF-KILTER ALGORITHM AND SOME OF ITS APPLICATIONS IN WATER

RESOURCES,
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering. For primary bibliographic entry see Field 6A.

RIVER BASIN MODELS AND THEIR APPLICA-

TION WITH SCARCITY OF DATA.
World Meteorological Organization, Geneva (Switzerland) For primary bibliographic entry see Field 4A. W76-05516

CAREFUL SAMPLE TAKING IS KEY TO SUC-CESSFUL WELLS, Universal Oil Products, St. Paul, Minn. Johnson

For primary bibliographic entry see Field 4B. W76-05560

A DRILLER'S GOOD FRIEND - THE ELEC-TRIC LOGGER, Universal Oil Products, St. Paul, Minn. Johnson

Div For primary bibliographic entry see Field 8G. W76-05561

QUURM - A REALISTIC URBAN RUNOFF MODEL, Queen's Univ., Kingston (Ontario).

For primary bibliographic entry see Field 2A. W76-05577

FLOOD HAZARD ANALYSES: BUF RIVER, AMHERST COUNTY, VIRGINIA. Soil Conservation Service, Richmond, Va. BUFFALO For primary bibliographic entry see Field 4A. W76-05643

FLOOD HAZARD ANALYSES: BLACKS RUN-COOKS CREEK, ROCKINGHAM COUNTY AND HARRISONBURG, VIRGINIA. Soil Conservation Service, Richmond, Va For primary bibliographic entry see Field 4A. W76-05644

FLOOD PLAIN INFORMATION: ILLINOIS AND MICHIGAN CANAL, ROCK RUN CREEK, THORNE CREEK, JOLIET, ILLINOIS. Army Engineer District, Chicago, Ill. For primary bibliographic entry see Field 4A. W76-05645

SPECIAL FLOOD HAZARD INFORMATION REPORT: HOWELL CREEK BASIN LAKES, ORANGE COUNTY, FLORIDA, Army Engineer District, Jacksonville, Fla For primary bibliographic entry see Field 4A. W76-05646

FLOOD PLAIN INFORMATION: LITTLE MC-MULLEN CREEK, JESUP, GEORGIA. Army Engineer District, Savannah, Ga For primary bibliographic entry see Field 4A. W76-05648

FORECASTING WATER LEVE AQUIFERS BY NUMERICAL SEMIHYBRID METHODS, LEVELS Technion-Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F. W76-05686

DETERMINING AQUIFER COEFFICIENTS FROM RESIDUAL DRAWDOWN DATA, Ottawa Department of the Environment, (Ontario). Inland Waters Directorate. For primary bibliographic entry see Field 2F. W76-05689

TREND ANALYSIS OF ANNUAL INDIAN RAIN.

Institute of Tropical Meteorology, Poona (India). For primary bibliographic entry see Field 2B. W76-05691

CONTINUOUS SEASONAL PROBABILITY OF EXTREME RAINFALL EVENTS, Agricultural Research Service, Southeast Watershed Research Center. For primary bibliographic entry see Field 2B. W76-05692

STATISTICS OF RAINGAGE DATA, McGill Univ., Montreal (Quebec). Dept. of Physics. For primary bibliographic entry see Field 2B. W76-05693

DEVELOPMENT AND FIELD TESTING OF A BASIN HYDROLOGY SIMULATOR, Texas Univ. at Austin. Dept. of Petroleum Engineering. For primary bibliographic entry see Field 2A. W76-05745

TORONTO'S APPROACH TO PREVENTIVE MAINTENANCE FOR TREATMENT PLANTS, Metropolitan Toronto Dept. of Works (Ontario). Water Pollution Control Div. For primary bibliographic entry see Field 5F. W76-05780

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SOCIAL SCIENCE DATA BANKS AND THE IN-STITUTE FOR WATER RESOURCES, American Univ., Washington, D.C. or primary bibliographic entry see Field 6B. W76-05822

MODELING THE EFFECT OF WASTE DISCHARGES IN A SMALL MOUNTAIN STREAM,
Virginia Polytechnic Inst. and State Univ.,
Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W76-05834

VERTICAL ELECTRICAL RESISTIVITY SOUNDINGS TO LOCATE GROUND WATER RESOURCES: A FEASIBILITY STUDY, Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences. For primary bibliographic entry see Field 4B. W76-05835

SELECTED WATER-QUALITY DATA FROM FALLEN LEAF LAKE, EL DORADO COUNTY, CALIFORNIA, JUNE THROUGH OCTOBER 1974, Geological Survey, Menlo Park, Calif.

R. H. Fuller. Open-file report, November 1975. 38 p, 2 fig, 9 tab. 4 ref.

Descriptors: *Water quality, *Baseline studies, *Environmental effects, *Alpine, *Lakes, *Environmental effects, Apine, Lakes, Streams, *California, Sampling, Water analysis, Chemical properties, Biological properties, Physical properties, Limnology, Inflow, *Basic data collections.
Identifiers: *Fallen Leaf Lake(Calif), El Dorado County(Calif).

In 1974 the U.S. Geological Survey entered into a cooperative agreement with the California Departcooperative agreement with the Cantorna Department of Water Resources to study the limnology of Fallen Leaf Lake and adjacent streams. The lake is in El Dorado County, California, near the crest of the Sierra Nevada about 23 miles southwest of Reno, Nevada. The study was undertaken to help develop a better understanding of selected characteristics of a high-altitude dilutesolution lake-stream system and the effect of man on the system. Fallen Leaf Lake and the adjacent streams were chosen because the lake represents an alpine system in a basin that has had limited development for a number of years. Water samples were collected and field measurements were pies were concerted and ried measurements were made regularly at two stations in Fallen Leaf Lake, one station in Glen Alpine Creek, one in Cathedral Creek, and at two stations in Taylor Creek. Physical, chemical and biological data are tabulated. (Woodard-USGS) W76-05848

A DIGITAL-COMPUTER MODEL FOR ESTI-MATING HYDROLOGIC CHANGES IN THE AQUIFER SYSTEM IN DANE COUNTY, WISCONSIN, Geological Survey, Madison, Wis.

For primary bibliographic entry see Field 2F. W76-05851

LIMNOLOGICAL DATA FOR THE MAJOR STREAMS IN CHESTER COUNTY, PENNSYL-VANIA.

Geological Survey, Harrisburg, Pa. B. W. Lium Open-file report, January 1976, 219 p, 1 fig, 3 tab. Descriptors: *Baseline studies, *Water quality, *Streams, *Pennsylvania, *Urbanization, Basic data collections, Water analysis, Chemical properties, Biological properties, Physical properties. Identifiers: *Chester County(Pa).

Limnological data on major streams in Chester County, Pa., are tabulated to provide a base line as to the present stream conditions. As land-use patterns change and further urbanization takes place, it is anticipated that these data will serve as a basis for comparison of conditions in the future. The 13 basins encompass a total drainage area of 697 sq mi of the 760 sq mi within Chester County. Four of the streams are tributaries to the Schuylkill River and include Pickering, Stony Run, Pigeon, and French Creek. Tributaries to the Delaware River include Darby, Crum, Ridley, Chester, Red Clay, and White Clay Creeks. The Elk Creeks flow into the Chesapeake Bay. The Brandywine is a tributary to the Christiana River, itself a tributary to the Delaware. The Octoraro Creek is a tributary to the Susquehanna River. Chester County, which is located in the Piedmont area of Pennsylvania, is undergoing rapid transition from a rural to a suburban population. Chemical, physical, and biological data were collected at 50 sites from fall 1969 through fall 1974. (Woodard-USGS)

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN THE NORTHERN GREAT PLAINS COAL REGION OF EASTERN MONTANA, 1975-76, Geological Survey, Helena, Mont. Open-file report, January 1976. 29 p, 10 fig.

*Basic data collections, *Water Descriptors: resources development, Water quality, Montana, *Coal mines, Hydrologic data, Groundwater, Surface waters, Water yield, Aquifers, Water supply, Sediment transport.

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This report presents the water data-collection program and interpretive hydrologic investigations that are being conducted by the U.S. Geological Survey in the Northern Great Plains region of eastern Montana. The area is of intense interest for coal companies, utilities, State and Federal agencies, universities, private citizens, landowners, and environmental groups. In October 1975 there were 45 streamflow and 64 water-quality data-collection stations in the region for collection of streamflow, chemical-quality, sediment, and tem-perature data. These stations are located on all types of streams from the mainstem Yellowstone and Missouri Rivers to small ephemeral and intermittent streams that drain proposed mine areas. Groundwater investigations are being conducted to determine the areal hydrology of the Madison Group and associated Paleozoic rocks and the areal and site hydrology of shallow aquifers in the Fort Union Formation, including the coal beds. Available data, mostly from oil tests, indicate that the Madison may yield water suitable for use in energy development in the Northern Great Plains coal region. Fieldwork in the shallow groundwater study consists principally of an inventory of wells and springs and construction of wells for water sampling, aquifer testing, and water-level mea-surements. A computer model is being constructed to determine the effect on stream temperature of selected increases in withdrawal rates, and thus reduced flow, of the Yellowstone River from Billings to Sidney, Mont. (Woodard-USGS) W76-05853

STEADY-STATE SEGMENTED DISSOLVED-

OXYGEN MODEL, Geological Survey, Bay Saint Louis, Miss. For primary bibliographic entry see Field 5B. W76-05855

EVALUATION OF DATA AVAILABILITY AND EXAMPLES OF MODELING FOR GROUND-

WATER MANAGEMENT ON CAPE COD, MAS-

SACHUSETTS, Geological Survey, Boston, Mass. For primary bibliographic entry see Field 4B. W76-05856

TABLE OF DATA ON WATER QUALITY OF BAKER LAKE NEAR MOUNT BAKER, WASHINGTON,

Geological Survey, Tacoma, Wash. G. C. Bortleson, and R. T. Wilson. Open-file report 76-195, February 1976, 12 p. 2 fig.

Descriptors: *Water quality, *Reservoirs, *Volcanoes, *Gases, *Washington, Environmental effects, Data collections, Water analysis, Specific conductivity, Hydrogen ion concentration, Water temperature, Dissolved oxygen.

Identifiers: *Baker Lake(Wash), *Mount Baker(Wash).

On March 10, 1975, volcanic activity on Mount Baker, Wash., increased dramatically in the form of new or greater emanations of heat, steam and other gases, and ash from a known fumarole field in Sherman Crater. The greater heat increased subglacial melting and subsidence of ice in the center of the crater. Flow of acid-rich waters into Boulder Creek apparently increased also. Boulder Creek discharges into Baker Lake, which is a reservoir used primarily for power generation but also for recreation, sport fishery, and salmon migration. This apparent increase in acidity of Boulder Creek water has raised questions about possible detrimental effects on Baker Lake. A preliminary survey was made in September 1975 by the U.S. Geological Survey to measure various water-quality characteristics in Baker Lake near the inflow of Boulder Creek. Data are tabulated from six transects on Baker Lake trending approximately perpendicular to Boulder Creek channels (or plumes of Boulder Creek water in the lake) and roughly along bottom contours, and one transect about 1.1 miles downlake from the southermost channel of Boulder Creek. On September 3, the first day of the lake survey, water at the mouth of Boulder Creek had a temperature of 10.0 deg C, specific conductance of 262 micromhos, and pH of 3.8. The estimated discharge from Boulder Creek was 75 cfs. (Woodard-USGS) W76-05857

HYDROGEOCHEMICAL DATA FROM IN-VESTIGATION OF WATER QUALITY IN SEWERED AND UNSEWERED AREAS, SOUTHERN NASSAU COUNTY, LONG ISLAND, NEW YORK,

Geological Survey, Mineola, N.Y.
N. M. Perlmutter, and E. Koch.
Long Island Water Resources Bulletin LIWR-4, 1975. 37 p, 2 fig, 1 plate, 4 tab, 7 ref.

Descriptors: *Water quality, *Chemical analysis, *Basic data collections, *Water analysis, *New York, Environmental effects, Sewage, Septic tanks, Cesspools, Sewerage, Pipelines, Sewage disposal, Surface waters, Water pollution sources, Pollutant identification.

Identifiers: *Long Island(NY).

About 1,000 chemical analyses of groundwater and surface-water samples collected from 1948 to 1972 in a 180 sq mi area of southern Nassau County, N.Y., are tabulated. The analyses are useful in planning and studying the development of water resources in the county. The data represent water samples from groundwater-fed streams and confined and unconfined unconsolidated aquifers composed of gravel, sand, silt, and clay of Pleistocene and Late Cretaceous age. The analyses also represent one of the few modern regional compilations of hydrogeochemical data that show a side-by-side comparison of water quality before and after replacement of several hundred thousand cesspools by public sewers. The sewered

part of the study area consists of Nassau County Sewer District 2 and the village of Freeport. The presently (1972) unsewered part of the study area consists of Nassau County Sewer District 3, where sewer construction, now in progress, is scheduled for completion in 1983. Public water-supply systems, which serve most of the population, draw water mainly from the Magothy aquifer and to a small extent from the Lloyd and the upper glacial suran extent from the Lloyd and the upper glacial aquifers. In 1970, water from public-supply wells in the study area was pumped at a rate of about 140 mgd. No surface water is used for public supply in the county. (Woodard-USGS) W76-05858

FLORIDAN AQUIFER IN NORTHEAST FLORIDA--THREE MAPS--HARDNESS OF WATER, CHLORIDE CONCENTRATION, AND POTENTIOMETRIC SURFACE, MAY 1974, Geological Survey, Tallahassee, Fla.

Open-file report FL 75003, 1975, 3 sheets, 3 maps,

Descriptors: *Aquifer characteristics, *Florida, *Maps, *Groundwater, Hydrologic data, *Chlorides, *Hardness(Water), Water levels, Contours, Mapping. Identifiers: Floridan aquifer, Northeast Florida.

Lines on 3 separate maps of the Floridan aquifer in northeast Florida show equal intervals for (1) chloride concentration, (2) water hardness, and (3) potentiometric data. (Woodard-USGS)

THE 1973 MISSISSIPPI RIVER BASIN FLOOD: COMPILATION AND ANALYSES OF METEOROLOGIC, STREAMFLOW, AND SEDI-MENT DATA,

National Weather Service, Silver Spring, Md.; and Geological Survey, Reston, Va. For primary bibliographic entry see Field 2E. W76-05860

AVAILABILITY OF GROUND WATER IN THE ANDROSCOGGIN RIVER BASIN, NORTHERN NEW HAMPSHIRE,

Geological Survey, Concord, N.H. J. E. Cotton. Water-Resources Investigations 22-75, 1975. 1 sheet, 1 map, 2 ref.

Descriptors: *Groundwater resources, *Water quality, *Available water, *New Hampshire, River basins, Hydrologic data, Maps, Water wells, Aquifers, Aquifer characteristics. Identifiers: *Androscoggin River basin(NH).

This report provides a guide for groundwater ex-ploration and for water- and land-use planning and management in the Androscoggin River basin in northern New Hampshire. Sufficient amounts of water to supply single family homes is available from the bedrock aquifer nearly everywhere in the basin. Relatively thin and narrow, unconsolidated aquifers of sand or sand and gravel capable of sustaining the moderate and high yields generally required by industries and municipalities are found required by industries and municipanities are found only in major stream valleys. The map provides a preliminary assessment of the availability of groundwater, as determined by estimating the capability of the aquifers to store and transmit water. On the map, aquifers are rated as having water. On the map, aquiters are rated as naving high, medium, or low potential to yield water. The groundwater is generally of good chemical quality. Most of it is clear and colorless, contains no suspended matter and practically no bacteria, and is low in dissolved-solids concentration. Also, it is generally soft (0-60mg/litre of hardness) or moderately hard (61-120 mg/litre). Several waterquality problems may occur within the basin. Iron quanty proteins may occur within the basin. Iron and manganese may occur in concentrations greater than the limits for drinking water, 0.3 and 0.05 mg/litre respectively, recomended by the U.S. Public Health Service (1962). (Woodard-USGS) W76-05862

Field 7—RESOURCES DATA

Group 7C-Evaluation, Processing and Publication

COMMENT UPON MULTIVARIATE SYNTHETIC HYDROLOGY, Centro di Ricerca IBM di Pisa (Italy). For primary bibliographic entry see Field 2A.

PUMPING-TEST ANALYSIS USING A DIS-CRETE TIME-DISCRETE SPACE NUMERICAL Birmingham Univ. (England). Dept. of Civil En-

gineering. For primary bibliographic entry see Field 4B. W76-05913

FINITE ELEMENT MESH GRADATION FOR

SURFACE WAVES, Waterloo Univ. (Ontario). Dept. of Earth Sciences For primary bibliographic entry see Field 8E. W76-05919

GEOLOGY AND WATER RESOURCES OF CHARLES MIX AND DOUGLAS COUNTIES, SOUTH DAKOTA, PART I: GEOLOGY, Geological Survey, Vermillion, S. D. For primary bibliographic entry see Field 4A. W76-05923

POSSIBILITY OF DETERMINING THE AREAS OF HEAVY PRECIPITATION BY DISCRETE REPRESENTATION OF RADAR DATA. For primary bibliographic entry see Field 2B. W76-05933

MAPS OF THE ELEMENTS OF THE HYDROLOGIC BUDGET OF ASIA,
Akademiya Nauk SSSR, Moscow. Institut Gregrafii. For primary bibliographic entry see Field 2A. W76-05934

PESTICIDE RESIDUE DYNAMICS IN A FOREST ECOSYSTEM: A COMPARTMENT

Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station. For primary bibliographic entry see Field 5B.

8. ENGINEERING WORKS

8A. Structures

UNDERWATER WALL STRUCTURE,

R. N. Hebel, Jr. U. S. Patent No. 3,927,533, 4 p, 8 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1572, December 23, 1975.

Descriptors: *Patents, *Shore protection, *Beach erosion, *Coastal structures, Littoral, Underwater, Piles(Foundations), *Erosion control, Sediment control, Sediment discharge. Identifiers: Underwater walls.

A permanent underwater wall structure is provided along a shoreline characterized by an offshore bar and a longshore trough which is indicative of the fact that the erosion process has begun. The invention is applicable to shore contours in which the offshore bar is no more than 150 feet from the normal shoreline at mean low tide. The permanent underwater wall structure comprises individual pilings driven in side-by-side relation to the ocean floor consisting of three sections. These are, two end sections which extend in spaced-apart relation from the vicinity of the shoreline, some 150 feet to the offshore bar and a middle section extending generally along the

offshore bar and connecting the two end sections. The individual pilings are driven to such a depth that all except the pilings adjacent to the shoreline are below the water level at mean low tide and generally are in a horizontal plane with the top of the offshore bar. For this reason, the flow of water toward the beach is unimpeded while the offshore and littoral currents carrying suspended material away are impeded thus allowing deposition of suspended material within the protected areas. Interlocking tongue and groove and guiding joints are provided for locking and guiding the individual pilings so as to form a unitary contiguous struc-ture. (Sinha-OEIS) W76-05523

APPARATUS AND METHOD FOR EXTRACTING WAVE ENERGY.

For primary bibliographic entry see Field 8C. W76-05538

CAREFUL SAMPLE TAKING IS KEY TO SUC-CESSFUL WELLS,

Universal Oil Products, St. Paul, Minn. Johnson For primary bibliographic entry see Field 4B.

W76-05560

USE OF FORMATION STABILIZER - A VALU-ABLE TECHNIQUE, Universal Oil Products, St. Paul, Minn. Johnson

Div. R. L. Schreurs

The Johnson Driller's Journal, Vol. 47, No. 4, p. 6-8. July-August 1975, 4 fig.

Descriptors: *Stabilization, *Water wells, Geologic formation, Well filters, Construction materials, Design.

Identifiers: *Naturally developed wells, *Artificially gravel-packed wells, *Formation stabilized wells.

The principles and applications of formation sta-bilizers are reviewed beginning with a brief description of naturally-developed and artificially gravel-packed wells. Each of these methods is discussed in relation to design, construction and development. The definition, function and benefits of formation stabilized wells are outlined. (Heiss-NWWA) W76-05564

ERDA'S TIGER LAGOON PROGRAM TO PROBE NEW ENERGY SOURCE. Drilling - DCW, Vol. 37, No. 4, p. 27, February

Descriptors: *Geothermal studies, *Energy conversion, *Electrical power production, Thermal power plants, *Louisiana, Oil wells, Energy. Identifiers: *Geopressure, *Geothermal energy, Depleted oil wells, Vermillion Parish(La).

A new geopressure, geothermal energy research program of the Energy Research and Development program of the Energy Research and Development Administration is described. The initial project is to explore the Tiger Lagoon area of Vermillion Parish, Louisiana for geopressure and geothermal energy sources to produce electricity. The Tiger energy sources to produce electricity. The Tiger Lagoon test will utilize an old Coastal States oil well at a depth between 13,000 and 14,000 feet. The project plans to exploit the three basic energy ources of pressure, temperature, and methane. Such energy sources could last as long as 25 years. The program's long range goal is to save six million barrels of fossil fuel imports per day by 1990. (Heiss-NWWA) W76-05568

EXPERIMENTAL WELL FIELD IS PUT TO For primary bibliographic entry see Field 8G. W76-05569

PROPOSAL FOR A TRANS-MEDITERRANEAN

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AQUEDUCT, Ottawa Univ. (Ontario). For primary bibliographic entry see Field 4A.

8B. Hydraulics

W76-05660

FLOWMETER FOR AN OPEN AQUEDUCT, Yamatake-Honeywell Co., Ltd., Tokyo (Japan). (Assignee)

For primary bibliographic entry see Field 7B. W76-05540

AIR ROTARY DRILLING WITH ORGANIC POLYMERS OFFERS MANY BENEFITS, Universal Oil Products Co., Denver, Colo. John-B. J. Reichmuth.

The Johnson Driller's Journal, Vol. 46, No. 6, p. 1-3, November-December 1974, 1 fig.

Descriptors: *Drilling fluids, *Rotary drilling, Clays, Viscosity, Lubricants, *Polymers, Drilling, Water wells.

Identifiers: *Organic polymers, Revert, *Fluid drilling, Shale swelling, Shale sloughing, *Air rotary drilling.

Two specific field examples of air rotary drilling with the organic polymer revert are presented. The properties and advantages of organic polymers lend themselves to efficient and economic operation of the rotary rig. Pounds of polymer used versus marsh funnel viscosity per second at varied temperatures are computed. (Heiss-NWWA) W76-05562

COSTS AS A GUIDE TO PRICING, Sydney Univ. (Australia). Dept. of Accounting. For primary bibliographic entry see Field 6C. W76-05570

NOMOGRAMS FOR SIMPLIFIED HYDRAULIC DIMENSIONING OF WASTE WATER DUCTS (NOMOGRAMME ZUR VEREINFACHTEN HYDRAULISCHEN BEMESSUNG VON AB-WASSER-KANAELEN),
For primary bibliographic entry see Field 5D.

W76-05610

A STABLE NUMERICAL MODEL FOR LOCAL

SCOUR, Windsor Univ. (Ontario). Dept. of Civil Engineer-

For primary bibliographic entry see Field 2J. W76-05666

EQUATIONS FOR RESISTANCE TO FLOW AND SEDIMENT TRANSPORT IN ALLUVIAL

Geological Survey, Reston, Va. For primary bibliographic entry see Field 2J. W76-05844

SEWER FLOW MEASUREMENT - A STATE-OF-THE-ART ASSESSMENT, EG and G Washington Analytical Services Center,

Inc., Rockville, Md.
For primary bibliographic entry see Field 5D. W76-05865

IMPACTS OF HYDROLOGIC MODIFICATION ON WATER QUALITY, MITRE Corp., McLean, Va. For primary bibliographic entry see Field 5G.

DISCHARGE EQUATIONS FOR HS. H. AND HL

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Agricultural Research Service, Stillwater, Okla., Water Conservation Structures Lab. W. R. Gwinn, and D. A. Parsons.

W. K. Gwinn, and D. A. Parsons. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY1, Proceedings Paper 11874, p 73-88, January 1976. 11 fig, 3 tab, 3 ref, 2 append.

Descriptors: *Channels, *Flumes, *Stage-discharge relations, *Streamflow, Hydraulic equipment, Hydrology, Runoff, Sediments, Stream gages, Flow, Calibrations, Submergence, Equations, Mathematical models, Equations, *Discharge(Water).

Identifiers: HS flumes, H flumes, HL flumes.

Generalized discharge equations for HS and H flumes were developed from the original data. Discharge equations for the HL flume were developed from a published rating table for a 4-ft flume. The equations were expressed in the basic dimensions of the control section. A direct solution for the effect of submergence on H flumes was presented in equation form. (Morris-ISWS) W76-05918

FINITE ELEMENT MESH GRADATION FOR

SURFACE WAVES, Waterloo Univ. (Ontario). Dept. of Earth Sciences.

For primary bibliographic entry see Field 8E. W76-05919

CONDITIONAL EXPECTED TSUNAMI INUN-DATION FOR HAWAII, Hawaii Univ., Honolulu.

W. M. Adams.

Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol. 101, No. WW4, Proceedings Paper 11702, p 319-329, November 1975. 8 fig, 17 ref.

Descriptors: *Coastal engineering, Environmental effects, *Tsunamis, *Hawaii, Flooding, Floods, Hazards, Shore protection, Waves(Water), Zoning, Statistics, Statistical methods, Seismic waves,

Numerical analysis, Islands.
Identifiers: *Peak amplitude, Domi
wavelength, Ray tracing, Tsunami magnitude.

Values were reported for a priori estimates of expected tsunami inundation -- conditioned by values for epicenter location and tsunami magnitude. Those values of conditional expected tsunami inundation (CETI) were restricted to coastal locations having historical observations of tsu-namis. Here a method was developed and applied for interpolating between these existing CETI to obtain predictions at coastal locations not pos-sessing historical tsunami data. The method used sessing instorted tsunam data. Ine method uses the existing CETI for calibrating (by best-fitting) the functional shape provided by the output from Bernard's time-stepping linear two-dimensional difference equations over a mesh having spatial increments of about 5 km and time steps of 15 sec (prototype time). Coastal position was measured along the coast from a reference point. Graphs for the interpolated CETI were given for the five major Hawaiian Islands, assuming a tsunami mag-nitude of 4 arriving from the north. (Lee-ISWS) W76-05920

WIND EFFECTS ON STREAM FLOWS, Delaware Univ., Newark. Coll. of Marine Studies; and Delaware Univ., Newark. Dept. of Civil En-

For primary bibliographic entry see Field 2E. W76-05921

COMPARATIVE ESTIMATE OF ENERGY LOSSES IN BODIES OF WATER, AND QUIET AND TURBULENT FLOWS, V. A. Znamenskiy.

Soviet Hydrology, Selected Papers, No. 5, p 395-404, 1973. 3 fig. 1 tab, 8 ref. Translated from Trudy Gossudarstvennogo Gidrologicheskogo Instituta, No. 203, p 186-199, 1973.

Descriptors: *Energy loss, *Flow, *Turbulent flow, *Laminar flow, Reynolds number, Froude number, Energy dissipation, Energy, Roughness(Hydraulic), Streamflow, Bodies of water, Channel flow, Fluid friction, Fluid mechanics, Hydraulics, *Estimating. Identifiers: Rapids.

An analysis of experimental and field data showed that the main criterion for separating flows according to the nature of energy losses is the relation as-sociating the slope of the flow, the Reynolds and Froude numbers, and the relative smoothness of the bottom surface. This relation can be expressed analytically for flows where roughness has a static effect (bodies of water and rapids). The depen-dence on H/delta is less determinate for watercourses, where bottom roughness is determined by mobile channel forms. Under otherwise equal conditions for all flows, a decrease in relative smoothness H/delta corresponds to a decrease of the Re/Fr ratio, testifying to the increasing effect of the Froude number with an increase in roughness or a decrease in flow depth. The analytical relation for hydraulic resistance, obtained for bodies of water, agreed with the deductions of the semi-empirical turbulence theory of L. Prandtl and also with the results of experimental investigations of the kinematic characteristics of the bottom layer. A relation was proposed for flows in bodies of water that makes it possible to determine average velocity in the presence of a water-surface slope, as well as a relation for determining the coefficient of eddy flux for the entire flow. (Sims-(SWS) W76-05924

ESTIMATE OF THE RATE OF TURBULENT MIXING OF THE FLUID IN WIND-DRIVEN CURRENTS FROM THE RESULTS OF MOV-ING AND STILL PARTICLE PHOTOGRAPHY,

A. S. Sudol'skiy.

Soviet Hydrology, Selected Papers, No. 2, p 83-90, 1974. 3 fig, 2 tab, 11 ref. Translated from Trudy Gossudarstvennogo Gidrologicheskogo Instituta, No. 216, p 25-35, 1974.

*Turbulence, *Currents(Water), Winds. *Waves(Water). Flumes, *Photography, Laboratory tests, Flow, Tracers, *Estimating, Forecasting. Identifiers: Wind-driven currents, *Turbulent mix-

Still and moving photographs of zero buoyancy particles in water, taken with exposures equal to or exceeding the period of wind waves by several factors, make it possible to describe the displace-ment of a fluid in a wind-driven current produced by various kinds of disturbances and structural formations whose dimensions are close to the depth of flow or one order of magnitude larger. Coefficients of turbulent mixing that most fully reflect the actual turbulence of a wind-driven cur-rent were obtained by a formula which allows for the pulsations of the longitudinal and vertical components of current velocity. The character of the vertical distribution of the coefficients of turbulent mixing in a wind driven current in the presence of differently directed fluid transport varies as a function of the water depth divided by the average wavelength. The coefficients of turbulent mixing, averaged over the depth of the water, are clearly associated at each given depth with wind speed, wave height, and the velocity of the winddriven current. The experimental values of the coefficients of turbulent mixing exceed by many factors the computed values, thus indicating that such factors as the different direction of fluid transport and the variations of neighboring waves in a wave system, which cannot be accounted for by theoretical methods, have a considerable effect

on the turbulence of a wind-driven current. (Sims -ISWS) W76-05932

STREAM BED STABILIZATION IN ENFIELD

CREEK, NEW YORK, New York State Dept. of Environmental Conservation, Delmar. Wildlife Research Lab. For primary bibliographic entry see Field 81. W76-06145

8C. Hydraulic Machinery

WATER CURRENT POWER GENERATOR SYSTEM.

U.S. Patent No. 3,928,771, 3 p, 7 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 941, No 4, p 1934, December 23, 1975.

Descriptors: *Patents, *Tidal streams, *Tidal energy, *Tidal powerplants, *Energy conversion, Energy transfer, Ocean currents, Ships. Identifiers: Endless belts, Water wheels.

A water current power generator system is comprised of one or more generator ships firmly anchored to the water bottom to generate power from sea currents or the tidal flow of rivers. The hull of a typical ship includes a shaped inlet where the moving water enters and drives blades hinged to a toothed belt which moves about a pair of rol-lers. As the blades move about the forward roller, the hinged blades are driven outward to a right angle position to be driven by the water flow. The blades fold into a collapsed position as they pass over the rear roller and move in a direction opposite the water flow thereby minimizing re-sistance to the water flow. Generally, a pair of toothed belts are provided within each shaped inlet with a thrust member between to direct the water toward the blades. The belts are mounted verti-cally within the hull to encounter as much of the water pressure as possible. The water then flows out the rear of the hull through a shaped outlet which is smaller than the inlet, in an alternate plan, vertical water wheels with collapsible blades are used instead of toothed belts. This variation would include at least one of such wheels positioned at the inlet and having hinged members serving as blades mounted on the wheels to catch the water flow thereby driving the wheel. The blade would then pivot to an open position minimizing re-sistance to the motion of the wheel as it moves around the axis of the wheel. (Sinha - OEIS) W76-05537

APPARATUS AND METHOD FOR EXTRACT-ING WAVE ENERGY,

S. H. Salter. U. S. Patent No. 3,928,967, 6 p, 6 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2024, December 30, 1975.

Descriptors: *Patents, *Energy, *Energy conversion, *Waves(Water), Wavelengths, Bodies of water, Hydraulics, Ocean waves, Hydraulic structures, Pumps, Electric power.

The invention comprises apparatus and method of The invention comprises apparatus and method of removing energy by providing wave engaging members so shaped so as to efficiently remove energy from the wave and which pivot about a substantially stationary second portion of the device such that energy is removed from the wave as the first member pivots in either direction rela-tive to the second part. The energy removing pivoted member is shaped such that in cross-sec-tion it is generally circular in shape for about 180 deg and which has a wave engaging portion comprising the forward portion of the member which is constructed of tangents extending from the curved rear section. The tangents are joined by a forward nose portion. The device is pivoted near the center

Field 8-ENGINEERING WORKS

Group 8C-Hydraulic Machinery

of the rear curved portion which results in little energy transfer between the rear portion of the member and the fluid. A substantial portion of the incident wave energy is extracted from the wave by the forward portion of the member as the member is pivoted about its port. In order to con-vert the pivotal motion of the wave removing member into useable energy, a pump such as a variable stroke rotary pump having a stator fixed relative to the supporting member and having a rotor which turns with the energy removing member can be provided. The output from the pump may be directly used to generate electricity on the floating supporting structure. (Sinha W76-05538

WAVE-ACTION POWER APPARATUS.

M. G. Tornabene

U.S. Patent No. 3,930,168, 8 p, 13 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 941, No 5, p 2369, December 30, 1975.

Descriptors: *Patents, *Energy, *Energy *Energy conversion, *Ocean currents, *Ocean waves, *Waves(Water), Electric power, Electric power production, Floats, Pumps, Turbines.

An apparatus is described for a wave-action energy-harnessing float which is responsive to wave action and currents but is durable against the destructive forces of seasonal twisting and turbulent currents and waves. The float is rotatably mounted on a lever mechanism such that the forces of water waves and currents are partially absorbed by the free revolving movement of the float. This allows the lever free reciprocal motion upward and downward within its bearing supports. The float is large enough for increased water-displacement capacity together with a dense mass which maximizes each upward and downward stroke responsive to variations in height of the float between crests and troughs of consecutive waves. A double-action piston-pump has a piston shaft extending coaxially throughout the length of the cylinder for effecting constant and equivalent volume displacement within the cylinder throughout its length irrespective of the location of the piston in to and fro movements. A circular annular flow path for moving water in conduits to and from the pump cylinder to and from turbine provides for continuous flow of water thus avoiding the stopping and starting of intermittant movement due to the waves. An electric generator is connected to the turbine. (Sinha - OEIS) W76-05549

SIPHON SYSTEM YIELDS CHILEAN PLANT MORE WATER,

Universal Oil Products, St. Paul, Minn. Johnson Div.

J. L. Mogg. The Johnson Drillers Journal, Vol. 47, No. 5, p 1-3,

September-October, 1975, 10 fig.

Descriptors: *Siphon, *Hydraulic structures, Underground storage, Pumps, Water quality, Water yield improvement, Design, Reservoir storage, Water wells, Iron compounds allunium, Pump turbines.

Identifiers: *High yield wells, *Siphon system hydraulics, Stainless steel well points, Calcium bicarbonate deposits, Well redevelopment, Fabrica de Celulosa, Bio Bio River, *Chile.

Engineer Miguel Concha Pinochet, a ground water specialist from Santiago, Chile, conceived and put into successful practice the principle of the siphon to augment his design for producing high yield (27,500 gallons per day) from a series of well points installed in the bed of a shallow river. The well points were all connected to a common header pipe which was connected through a siphon to an on shore, subsurface reservoir. High-capaci-ty, vertical turbine pumps in the subsurface reser-voir were installed which moved the water to its points of use within a factory complex. A well field, located on an adjacent river alluvial deposits, failed due to highly mineralized ground water and poor well construction materials. (Heiss-NWWA) W76-05550

RIG RESTORATION.

For primary bibliographic entry see Field 8G. W76-05555

COLORADO CITY SOLVES ITS SAND PUMP-INC PROBLEMS

Wright Water Engineers, Inc., Denver, Colo. R. D. Tafelski.

The Johnson Drillers Journal, Vol. 47, No. 2, p 1-3, March-April 1975, 2 fig.

Descriptors: *Particle size, *Well screens, Well casings, Gravels, Aquifers, Colorado, Pumping,

Water wells, *Pump testing.

Identifiers: Ogallala formation(Colo), Production rate decrease, Fine grain material, Excessive oump wear, Annulus structure, Pumping schedule, Burlington(Colo), *Sand pumping.

The City of Burlington, Colorado experienced problems with sand pumping and a consequent decrease in production rates of its seven municipal waterwells. Excessive water meter wear and primary water line blockage by sand were the serious problems. The fine-grained material in the Ogallala formation plus coarse angular gravel pack and slotted pipe were the prime cause of the difficulty. The situation reached its most serious stage when some of the wells began to pump gravel pack material causing excessive pump wear. Consulting engineers and city officials recognized the need for replacement wells. Test holes and subsequent production wells were optimumly placed for maximum yield and minimum particle intake. Special attention was given to gravel packing the well screen, casing and grouting procedures. Develop-ment was realized by careful backwashing to in-sure the integrity of the carefully placed gravel pack. Pumping tests were conducted at each production well after completion of the development. Transmissivity values were generally 17,000 to 23,000 gpd/ft. All wells were completely sand free. (Heiss-NWWA) W76-05559

AIR ROTARY DRILLING WITH ORGANIC POLYMERS OFFERS MANY BENEFITS, Universal Oil Products Co., Denver, Colo. John-

son Div. For primary bibliographic entry see Field 8B. W76-05562

PROPER SELECTION OF GRAVEL PACK IS

KEY TO SUCCESSFUL WELLS Universal Oil Products, St. Paul, Minn. Johnson

Div. A. J. Smith.

The Johnson Driller's Journal, Vol. 47, No. 4, p. 1-3, July-August 1975, 3 fig.

Descriptors: *Gravels. *Particle size Permiability, Fine aggregates, Sand pumping, *Well screens, Water wells. Identifiers: *Gravel pack design, Grain size dis-

tribution. Sand control

The use of a gravel pack increases particle size and permeability in the zone immediately surrounding the well screen. The geologic conditions of a fine uniform sand, a thick artesian aquifer, a loosely cemented sandstone and an extensively laminated formation favor the use of gravel packing material. The gravel packing material must be accurately sized to the aquifer to avoid wells that pump sand. Recently, it has been suggested that the medium gravel size should fall within a range of five to six times the formation particle diameter at the 50 percentile point of the sieve analysis. Steps are given for the design of artificial gravel packs for water wells. (Heiss-NWWA)

SIMPLE PROCEDURES CAN HELP REDUCE DRILL PIPE DAMAGE,

Chevron Oil Co., New Orleans, La.

R. W. Nicholson. World Oil, Vol. 178, No. 6, p. 73-77, May 1974, 6 fig. 11 ref.

Descriptors: *Drilling, *Fatigue(Mechanics), Drilling Pipes, equipment. Failure (Mechanics), *Tension, Strain, Mechanical properties, Testing procedures.

Identifiers: *Drill pipe failure, *Crooked holes, *Doglegs, Tool joints.

Doglegs have long been recognized as a major factor contributing to drill pipe failures and other drilling problems. Such problems can be greatly reduced by limiting dogleg severity to acceptable values. Crooked holes contribute to drill pipe fatigue and tool joint damage and increase chances for twist-offs, washouts, and casing wear. Drill pipe fatigue can occur due to sufficiently large alternating bending stress caused by rotation in a dogleg. This bending of drill pipe can also result in failure of the tool joint. (Gass-NWWA) W76-05572

HOW STEAM IS PRODUCED AND HANDLED AT THE GEYSERS.

R. E. Snyder.

World Oil, Vol. 180, No. 7, p. 43-46, June 1975, 10 fig. 1 tab. 6 ref.

Descriptors: *Geysers, *Steam, Electric power plants, *California, Drilling, Geothermal studies, Wells, Reservoirs, *Energy conversion, Cooling towers, *Condensation, Drill holes, *Heat flow. Identifiers: *Cluster wells, *The Geysers(Calif), *Geothermal energy.

Five drilling rigs are presently placing clusters of new geothermal wells in The Geysers area in anticipation of the construction of additional power plants. The new plants will raise total output from the current 502 megawatt (mw) to 897 mw. The geothermal reservoir consists of highly fractured, slightly metamorphosed sedimentary and igneous rocks of Cretaceous and upper Jurassic age. The heat source is probably a large magmatic body buried perhaps 10 miles or more below the surface. Steam production at The Geysers will gradually decline, not due to well bore plugging, but to depletion of reservoir pressure. Some recharging is possible and presently the remaining 20 percent of the condensed liquid from the generating plant is reinjected. The drilling of wells is made difficult by steep terrain. To compensate for this, directional drilling is often used. Deviated holes are also desirable since the drift can be controlled to cause the hole to cut as many fault planes as possible to expose maximum fracturing. Water enters the generating plant at 350 F as dry steam. The steam strikes the turbine and the heat energy is converted to rotational velocity which is transferred directly to the generator. The steam is then condensed in a chamber where its temperature is reduced to 120 F. This hot water is pumped to the cooling tower. Eight percent of the steam condensate is evaporated and the remainder is reinjected into the producing reservoir. (Gass-NWWA) W76-05574

TECHNICAL-ECONOMIC PRODUCT DESIGN AS TYPIFIED BY A SEWAGE PUMPING IN-

For primary bibliographic entry see Field 5D. W76-05591

STUDY OF TURBINE MIXERS FOR FLOW-THROUGH FLOCCULATION CHAMBERS (YYZKUM TURBINOVYCH MICHADEL PRO PRUTOCNE FLOKULACNI KOMORY), Vyzkumny Ustav Chemickych Zarizeni, Brno (Czechoslovakia).

For primary bibliographic entry see Field 5D. W76-05703

PLASTIC PIPE, PRESSURE SEWERS, MARK EXPANSION, Williams and Works, Grand Rapids, Mich

For primary bibliographic entry see Field 5D. W76-05765

AUTOMATION CAN BE SIMPLE, For primary bibliographic entry see Field 5D. W76-05797

8D. Soil Mechanics

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USE OF FORMATION STABILIZER - A VALU-ABLE TECHNIQUE, Universal Oil Products, St. Paul, Minn, Johnson

For primary bibliographic entry see Field 8A. W76-05564

PROPER SELECTION OF GRAVEL PACK IS KEY TO SUCCESSFUL WELLS, Universal Oil Products, St. Paul, Minn. Johnson

For primary bibliographic entry see Field 8C.

W76-05565

SEISMIC INSTRUMENTATION OF DAMS,

California Univ., Berkeley, Seismological Lab. B. A. Bolt, and D. E. Hudson. Journal of the Geotechnical Engineering Division,

American Society of Civil Engineers, Vol. 101, No. GT11, Proceedings Paper 11697, p 1095-1104, November 1975. 3 fig, 13 ref, 2 append.

Descriptors: *Dams, *Dynamics, Earthquakes, Seismic studies, Seismographs, Seismology, Instrumentation.

Identifiers: *Accelerometers, *Geotechnical en-gineering instrumentation, Seismic detection.

The desirability of installing seismic instruments on and near major dams was explained. Two types of instruments are required: (1) strong-motion accelerographs for recording potentially destructive ground shaking and resulting dam vibrations, and (2) sensitive seismographs for determining the local seismicity. A minimum of two strong-motion accelerographs should be installed on the dam and accelerographs should be installed on the dam and a minimum of two should be installed in the immediate vicinity of the dam. Each accelerograph should record three components of motion, should have a natural frequency of approximately 20 Hz, a recording speed of approximately 1 cm/s. The sensitive seismographs are intended to record the local seismicity in the vicinity of the dam site before construction, and to detect any changes in seismicity during reservoir filling. A minimum of three seismographs was recommended for installation in the vicinity of the dam site. A vertical-component seismometer (1 Hz - 5 Hz) with visual recorder and approximately 10,000 magnification at 1 Hz was recommended. (Lee-ISWS)

8E. Rock Mechanics and Geology

SEISMIC INSTRUMENTATION OF DAMS, California Univ., Berkeley, Seismological Lab. For primary bibliographic entry see Field 8D. W76-05667 FINITE ELEMENT MESH GRADATION FOR SURFACE WAVES, Waterloo Univ. (Ontario). Dept. of Earth

Sciences.

Sciences.
G. Segol, J. F. Abel, and P. C. Y. Lee.
Journal of the Geotechnical Engineering Division,
American Society of Civil Engineers, Vol. 101,
No. GT11, p 1177-1181, November 1975. 2 fig. 12

Descriptors: *Seismic waves, *Finite element analysis, *Wavelengths, Computers, *Model studies, Seismology, Analytical techniques, Free surfaces, Methodology.

Identifiers: *Mesh gradation, Elastic waves, Discretization.

Because the computer implementation of finite element techniques in the study of propagating seismic surface waves requires large commitments of core storage and execution time, analysts need be concerned both with minimizing the number of elements and nodes used and with evaluating the accuracy of the chosen discretization. The previously presented criteria were investigated to esti-mate how much coarser the element mesh can be made for regions away from the surface. Though the criterion for the ratio of element dimension perpendicular to the direction of propagation to the minimum wavelength of elastic waves propagating in the system should not exceed 1/12 is necessary near the surface for finite elements to produce highly accurate predictions of surface wave amplitudes, little deterioration in accuracy was detected if this ratio is equal to or less than 1/6 at the fixed base. (Singh-ISWS) W76-05919

8G. Materials

SIPHON SYSTEM YIELDS CHILEAN PLANT MORE WATER,

Universal Oil Products, St. Paul, Minn. Johnson

For primary bibliographic entry see Field 8C. W76-05550

PVC PIPE IN WATER DISTRIBUTION: RELIA-BILITY AND DURABILITY, Petrochemicals Co. Inc., Fort Worth, Tex.

W. D. Nesbeitt.

Journal of the American Water Works Associa-tion, Vol. 67, No. 10, p. 576-581, October 1975, 7

Descriptors: *Plastic pipes, *Distribution systems, Tensile strength, Materials testing, Stress, Strength. Identifiers: PVC pipes.

Defined and discussed are both the disadvantages and advantages afforded the consumer in the use of polyvinyl chloride (PVC) pipe. PVC pipe has proved to be a high quality water-piping material offering water-utility operators many advantageous properties that provide assurance of reliability and durability in water distribution systems. It is nearly non-biodegradable. PVC will not deteriorate or breakdown under the attack of bacteria or other microorganisms. However, PVC pipe is not suited to exposure to heavy concentrations of organic solvents, aromatics and ultraviolet rays. The dielectric properties of PVC render it perfectly suited for electrical insulation. The same dielectric properties also make it difficult to locate buried PVC pipe. PVC is somewhat flexible and will bend to compensate for shifting soil condi-tions. The operating temperatures of PVC pipe are between 0-120 degrees F. It is rated for per-formance at 73.4 degrees F. Lower temperatures cause it to become brittle and less flexible. Higher temperatures result in a loss of tensile strength and stiffness. Plastic pipe can withstand short-term pressure surges but is less capable of withstanding long-term pressure surges than cast iron pipe.

Failure to realize and capitalize on the various benefits afforded by the use of PVC pipe in water-utility systems can limit or eliminate some of the advantages afforded by the use of such pipe in modern municipal water-distribution systems. (Gass-NWWA) W76-05552

RIG RESTORATION. Water Well Journal, Vol. 30, No. 2, p. 26-27, February 1976.

Descriptors: *Drilling equipment, *Maintenance, Rehabilitation, Paints, *Cleaning, *Corrosion control, Abrasive blasting.

Identifiers: *Preventive maintenance, Com-pressed air cleaning, Solution cleaning, *Drilling

Preventive maintenance of well drilling rigs during the winter months is discussed. Cleaning supplies and methods are described in detail. A checklist of suggested procedures is given. Priming and paint-ing methods are mentioned including ionized paint spraying procedures. (Heiss-NWWA) W76-05555

A DRILLER'S GOOD FRIEND - THE ELEC-TRIC LOGGER.

Universal Oil Products, St. Paul, Minn. Johnson Div. R. W. Riewe.

The Johnson Drillers Journal, Vol. 47, No. 6, p 1-4, November-December 1975.

Descriptors: *Logging(Recording), *Electric well logging, *Resistivity, Drilling fluids, Water supply development, Drilling equipment, *Drillers logs, Boreholes, Wells, Identifiers: Mud probe, Borehole diameter.

The electric well logger is a valuable tool in any well drilling operation. When used with the driller's well log it provides a detailed description of every formation the drill bit encounters. The electric well logger measures the electronic parameters of spontaneous potential of the forma-tion and resistivity of the borehole fluids. However, an anomalous reading may occur when borehole fluids encountered in the previous forma-tion contaminate the fluids of another formation thereby creating a masking effect in the recorded log. Examples of this effect are given. (Heiss-NWWA) W76-05561

AIR ROTARY DRILLING WITH ORGANIC POLYMERS OFFERS MANY BENEFITS, Universal Oil Products Co., Denver, Colo, John-

For primary bibliographic entry see Field 8B.

W76-05562

USE OF FORMATION STABILIZER - A VALU-ABLE TECHNIQUE,

Universal Oil Products, St. Paul, Minn. Johnson Div.

For primary bibliographic entry see Field 8A. W76-05564

EXPERIMENTAL WELL FIELD IS PUT TO MANY USES, G. M. Erickson.

The Johnson Driller's Journal, Vol. 47, No. 4, p. 4-5, 12, July-August 1975, 1 fig.

Descriptors: *Drill holes, *Water wells, Well casing, Well screens, Rotary drilling, Well spacing, Testing procedures, Minnesota, *Test wells, Pumping, Tests.

Identifiers: *Experimental well field, Water well testing.

Group 8G-Materials

An experimental and research well field was constructed by UOP Incorported, Johnson Division at New Brighton, Minnesota. The facility will serve staff engineers and geologists as well as provide a demonstration site for the company's geophysical equipment and products. An unconsolidated formation was selected that could produce a maximum yield of 200 gallons per minute. The site was selected for a study of local well logs. Two cable tool wells and seven rotary wells were originally planned. Very accurate samples were taken throughout the drilling operation. The cable tool wells were planned as one 6 inch well and one 10 inch production well. The 6 inch well was developed using the single-pipe airline method for 13 hours. After development, it was concluded that the well should be capable of pumping at a rate of 1,500 to 2,000 gallons per minute on a short term basis. As a result, the plan to drill a 10 inch well was abandoned. In its place a new well was designed with a 16 inch casing at the top of the aquifer and 10 inch telescoping well screen. Coarse pea gravel was then used as a gravel pack. The well was developed using a process of alternate jetting with water and pumping air. The rotary wells were drilled at the same time as the cable tool wells. A 6 hour pumping test was performed in February 1972. Pumping rate was 1050 gallons per minute. Transmissibility was determined to be in excess of 400,000 gallons per day per foot with a specific capacity of 181 gallons per minute per foot of drawdown and a well efficiency of 90 percent. (Heiss-NWWA) W76-05569

SIMPLE PROCEDURES CAN HELP REDUCE DRILL PIPE DAMAGE,

Chevron Oil Co., New Orleans, La For primary bibliographic entry see Field 8C. W76-05572

CATHODIC INNER AND OUTER PROTECTION FOR A DOUBLE SYPHON FOR WASTE WATER (KATHODISCHER INNEN-UND AUS-SENSCHUTZ FUER EINEN ABWASSER-DOP-PELDUEKER)

For primary bibliographic entry see Field 5D. W76-05584

SEISMIC INSTRUMENTATION OF DAMS. California Univ., Berkeley, Seismological Lab. For primary bibliographic entry see Field 8D.

PLASTIC PIPE, PRESSURE SEWERS, MARK

EXPANSION, Williams and Works, Grand Rapids, Mich. For primary bibliographic entry see Field 5D. W76-05765

81. Fisheries Engineering

MACROBENTHIC POPULATION DYNAMICS IN INDIANA WATERS OF LAKE MICHIGAN IN 1970, Ball State Univ., Muncie, Ind.

For primary bibliographic entry see Field 5C. W76-05623

AN ICHTHYOFAUNAL SURVEY AND DISCUS-SION OF FISH SPECIES DIVERSITY AS AN IN-DICATOR OF WATER QUALITY, CODORUS CREEK DRAINAGE, PENNSYLVANIA. YORK COUNTY.

York Coll., Pa. For primary bibliographic entry see Field 5A. W76-05634 FECUNDITY OF THE BROWN BULLHEAD, ICTALURUS NEBULOSUS (LE SUEUR) IN A MINE ACID POLLUTED RIVER, West Virginia Univ., Morgantown

D. B. Fowler.

D. B. Fowier.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-251 167

\$5.00 in paper copy \$2.25 in microfiche. MS thesis

5 fig, 6 tab, 58 ref, 1 append. OWRT A-017
WVA(4), A-001-WVA(4).

Descriptors: *Fish, *Bullheads, *Fecundity, *Acid mine water, Water pollution effects, West Virginia, Sexual maturity, Fish reproduction, Fish eggs, Spawning, Acidic water.
Identifiers: *Brown bullhead, *Monongahela

River(W Va)

The sex ratio for brown bullheads in the Monogahela River, West Virginia, was 1.30 males:1.00 females in 1966; the true ratio was probably closer to 1.74:1.00 during non-spawning periods. Egg diameters from ripe females were 1.61-2.82 mm. Egg sizes did not differ between ovaries from the same female. Ova frequency distributions from mature bullheads were unimodal, indicating a single spawn per season. Ova diameters were larger and fecundity higher in 1966 than in 1968. Females reached maturity when approxi-mately 200 mm long and weighed 100 g. Ripe ova were slightly larger than 2 mm in diameter. Egg diameter was not related to fish size but was inversely proportional to fecundity. Fecundities were 818-7071 for ripe females and more closely related to gross weight than total body length. Fecundity was not related to spawning time. Regression analyses indicated than fecundity-length and fecundity-weight relationships were curvilinear. The best fitting regression line was produced by relating log fecundity to gross body weight. Evidence of ripe and spent ovaries during late spring and summer months suggested a lengthy awning season. Bullheads did not appear to have suffered reproductive impairment due to mine acid pollution which caused pH variations from 3.4-6.0. (Buchanan-Davidson--Wisconsin). W76-05641

ACCUMULATION AND ELIMINATION OF DIELDRIN BY CHANNEL (ICTALURUS PUNCTATUS),

Iowa Cooperative Fishery Unit, Ames For primary bibliographic entry see Field 5C. W76-05642

PARASITES OF FRESHWATER FISHES. A REVIEW OF THEIR CONTROL AND TREAT-MENT,

For primary bibliographic entry see Field 2H. W76-05953

STREAM BED STABILIZATION IN ENFIELD CREEK, NEW YORK, New York State Dept. of Environmental Conservation, Delmar. Wildlife Research Lab. B. J. Jackson.

N Y Fish Game J. 21(1), p 32-46, 1974.

Descriptors: *New York, *Streambeds, Stream stabilization, Trout, Gabions, Structures, Gravels. Identifiers: *Enfield Creek(NY), *Streambed sills.

This study was undertaken to observe the per-formance of bed sills in stabilizing a high-gradient trout stream subjected to severe headcutting. Gabion structures were installed in Enfield Creek, New York, in 1967. A topographical survey of the stream bed was made prior to installation and in 1968, 1970, 1971 and 1973. The sills were imnediately effective in arresting headcutting and in accumulating gravel material and they had a distinct stabilizing effect for almost 0.8 mile downstream. Gabion construction is discussed and a theory for partial failure of the 2 lower sills dur-ing the June 1972 flood is postulated.--Copyright 1974, Biological Abstracts, Inc. W76-06145

10. SCIENTIFIC AND TECHNICAL INFORMATION

101

SEV OF-EG

Inc. For W76

10B. Reference and Retrieval

CANADIAN WATER RESOURCES INFORMA-TION: A NETWORK APPROACH, Department of the Environment, Burlingto (Ontario). For primary bibliographic entry see Field 10D. W76-05952

10C. Secondary Publication And Distribution

SOCIAL IMPACT ASSESSMENT: ANALYTIC BIBLIOGRAPHY, Brown Univ., Providence, R. I. For primary bibliographic entry see Field 6B. W76-05820

SECOND ANNOTATED BIBLIOGRAPHY ON ANOTATED BIBLIOGRAPH OF BIOLOGICAL EFFECTS OF METALS I! AQUATIC ENVIRONMENTS, Environmental Research Lab., Narragansett, R.I. IN For primary bibliographic entry see Field 5C. W76-05863

10D. Specialized Information Center Services

CANADIAN WATER RESOURCES INFORMA-TION: A NETWORK APPROACH,
Department of the Environment, Burlingto (Ontario). J. P. H. Batteke, D. M. Heaps, and M. A. Mercier. Inf Storage Retr. 10(3/4): 85-99. Illus. 1974.

Descriptors: *Canada, *Information storage and retrieval, *Information exchange, Data collections, Water resources, Indexing, Thesauri, *Networks, *Documentation, Publications. Identifiers: *WATDOC.

The Water Resources Document Reference System, Environment Canada (WATDOC), was established to increase awareness of environmental information related to water resources. Participants are found throughout Canada at all levels of management and research. The designers of WAT-DOC reconcile the conflicts posed by a centralized data base operated by a decentralized community through the recognition of certain economic conditions and through the use of network techniques. Every effort is made to obtain the cooperation of users and suppliers of information, to provide access to data bases, to incorporate advances in technology, and to search for system improvement. 'Invisible colleges' are established through seminars and personal contact and correspondence. The information in the data base is identified by indexing and classification methods combined, through the use of a thesaurus concordance. All data bases within the network may be accessed directly by on-line or batch methods, by telephone-query or specialist-terminal interaction, or by mail. Relevant research is supported. Research related to this report resulted in the development of a thesaurus concordance and in a set of programs to support an interactive on-line classification-linked thesaurus for indexing, classification, search and retrieval. Implementation, operation, and development of WATDOC are discussed in detail .- Copyright 1974, Biological Abstracts, Inc. W76-05952

10F. Preparation Of Reviews

SEWER FLOW MEASUREMENT - A STATE-OF-THE-ART ASSESSMENT, EG and G Washington Analytical Services Center, Inc., Rockville, Md. For primary bibliographic entry see Field 05D. W76-05865

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Neb Rive W76 ACID Effe Wat Sodi W76

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SUBJECT INDEX

ABANDONMENT Wilber V. Western Properties (Whether an Ar-	Biological Treatment of Dyes, W76-05737 5D	Regulations Pertaining to Oil Spills into Public Waters.
tificially Altered Watercourse is a Natural or Artificial Channel a Matter of Law).	Supernatant Doesn't Have to Ruin Effluent	W76-06071 5G
W76-06103 6E	Quality,	Thermal Processing and Land Disposal of Solid
ACCELEROMETERS	W76-05772 5D	Waste.
Seismic Instrumentation of Dams,	Low Cost Phosphorous Removal,	W76-06082 5D
W76-05667 8D	W76-05786 5D	Evaluation of Economic Benefits for Flood
ACCRETION	Factors in the Purification of Flowing Sewage	Control and Water Resource Planning. W76-06083 4A
State V Corvallis Sand and Gravel Co. (Avulsion: Newly Submerged Lands Title in Former Owner But Paramount Navigational	and Activated Sludge Process, Part I, W76-05795 5D	ADSORPTION
Servitude in State).	This Plant Can Use 5 Sludge Processes,	Interactions of Mercury with Aquatic and
W76-06111 6E	W76-05798 5D	Edaphic Environments, W76-05601 5B
ACID MINE WATER	Engineers Can Exert Process Control Over	A EB ATER I ACCONG
Fecundity of the Brown Bullhead, Ictalurus Nebulosus (Le Sueur) in a Mine Acid Polluted	Digester Inputs, W76-05807 5D	AERATED LAGOONS Experimental Study of the Purification of Effluents from the Manufacture of Bleached
River, W76-05641 81	ADJACENT LAND OWNERS	Bisulfite Pulp by Aeration Lagooning (Etude
	Williams V. Duke Power Co. (Silting of Stream,	experimentale de l'epuration par lagunage aere
ACID TREATMENT (SOILS)	Ponds, and Lake). W76-06088 6E	de liqueurs bisulfitiques de pate de cellulose
Effect of Surface Applied Sulfuric Acid on Water Penetration into Dry Calcareous and	W76-06088 6E	blanchie), W76-05718 5D
Sodic Soils,	ADJACENT LANDOWNERS	W 70-05716
W76-05907 5G	Bartley V. Sone (Right of Individual to the Use	Aerated Lagoons Solve Town's Site Problems,
CIDIC WATER	of Spring Waters Located Wholly on His Land for Any Purpose).	W76-05799 5D
ACIDIC WATER Method for Removing Soluble Selenium from	W76-06099 6E	AERATION
Acidic Waste Water,	-	Bio Pond Aerator,
W76-05986 5D	Story V. Hefner (Deeds Purporting to Divide Lake in Half Ineffective to Prohibit Use of En-	W76-05535 5D
ACTIVATED CARBON	tire Surface for Recreational Purposes).	Alignment of Longitudinally Aerating Aeration
Carbon Wastewater Treatment Process. W76-05583 5D	W76-06102 6E	Tanks (Naladka aerotankov prodlennoy aerat-
W76-05583 5D	ADMINISTRATIVE AGENCIES	sii),
Activated Carbon Treatment of Pulp and Paper Waste Water,	Utah Water Pollution Control Act. W76-06077 5G	W76-05587 5D
W76-05730 5D	Thermal Processing and Land Disposal of Solid	How Does Tank Geometry Affect the Oxygen Transfer Rate of Mechanical Surface Aerators.
Treatment of Dye Wastes With Granular Ac-	Waste.	W76-05593 5D
tivated Carbon,	W76-06082 5D	Awt Plant is Top Performer,
W76-05738 5D	Evaluation of Economic Benefits for Flood	W76-05769 5D
ACTIVATED SLUDGE	Control and Water Resource Planning.	D D' 1 111 PM . W. 1
Waste Water and Sewage Treatment.	W76-06083 4A	Process Biodegradable Effluent Underground. W76-05776 5D
W76-05580 5D	Designation and Determination of Removability	W 10-03770
New System Puts the Wood to Wastewater, W76-05586 5D	of Hazardous Substances from Water. W76-06084 5G	Aerated Lagoons Solve Town's Site Problems, W76-05799 5D
Conversion of a Trickling Filter Plant to Ac-	Timber Products Processing Point Source	Water Purification Apparatus and Timing
tivated Sludge, W76-05588 5D	CategoryEffluent Guidelines and Standards. W76-06085 5G	Device for Initiating A Backwashing Cycle, W76-05968 5F
Beneval of America Nitrocon by Cotalesia	Obstruction of Streams or Lakes by Fyke Nets	D' 1 14' EL
Removal of Ammonia Nitrogen by Catalytic Oxidation Filter Bed (Sesshoku sanka rosho ni	or Other Devices.	Dissolved Air Floatation System, W76-05976 5D
yoru ammonia-set chisso no jokyo),	W76-06089 6E	
W76-05589 5D	ADMINISTRATIVE DECISIONS	AERATOR SPEEDS How Does Tank Geometry Affect the Oxygen
Influence of Temperature on Biological Purifi- cation of Paper Mill Effluent (Influenza della	Measuring and Minimizing the Social Cost of Environmental Pollution,	Transfer Rate of Mechanical Surface Aerators. W76-05593
temperatura sulla depurazione biologica di un	W76-05824 5G	
refluo di cartiera), W76-05700 5D	In Re: Marine Equities Corp. V. Biggane (Tidal	AESTHETICS
30	Wetland Act Constitutional as Applied to Ap-	A Technique for Environmental Decision Mak- ing Using Quantified Social and Aesthetic
Super Teamwork gives Green Bay (Wisconsin)	off States Island	Values,
a Super Waste Treatment Plant, W76-05706 5D	Off Staten Island). W76-06100 6E	W76-05825 50
	ADMINISTDATIVE CHIRELINES	AFRICA
Biological Treatment by a System of Activated Sludge Applied to the Effluent Waters of a Corrugated Board Plant.	ADMINISTRATIVE GUIDELINES Thermal Processing and Land Disposal of Solid Waste.	Surface Energy Budget of Some Climatic Regimes in West Africa,
W76-05713 5D	W76-06082 5D	W76-06006 2E
		ACDEPMENTS
Purification of Waste Waters at the Kraft Mill of 'La Cellulose Des Ardennes' (Epuration des	ADOPTION OF PRACTICES Michigan Wastewater Reporting and Surveil-	AGREEMENTS International River Basin Cooperation: Some
caux residuaires a La Cellulose des Ardennes),	lance Fees Rules.	Factors Influencing Agreement,
W76-05721 5D	W76-06067 5G	W76-05758 6F

AGRICULTURAL WATERSHEDS

AGRICULTURAL WATERSHEDS Slope Runoff and Its Change Under the Effect of Agricultural and Forest Improvement Prac-	Influences of Some Freshwater Plants on the Development and Survival of Mosquito Larvae in British Columbia,	AMMONIA REMOVAL AND RECOVERY PROCESS (ARPP) Converting Sewage into Savings.
tices, W76-05927 4C	W76-06048 5G	W76-05790 5D
	ALGORITHMS	AMMONIUM SULFATE FERTILIZER
AGRICULTURE Eutrophication of an Inland Lake in Ireland in	The Out-Of-Kilter Algorithm and Some of its	Converting Sewage into Savings. W76-05790 5D
Association with the Intensification of Pig	Applications in Water Resources, W76-05515 6A	W 70-03790
Farming in the Catchment Areas,		ANAEROBIC CONDITIONS
W76-05629 5C	Comment Upon Multivariate Synthetic	Biological Denitrification and its Application in Treatment of High-Nitrate Waste Water,
AIR POLLUTION	Hydrology, W76-05909 2A	W76-05792 5D
Management of Environmental Quality: Obser-	1170-05707	
vations on Recent Experience in the United	ALLEGHENY RIVER	Method and Apparatus for the Anaerobic Digestion of Decomposable Organic Materials,
States and the United Kingdom, W76-05659 5G	To Amend the Wild and Scenic Rivers Act (on S. 10 and S. 1004).	W76-05981 5D
AIR ROTARY DRILLING	W76-06081 6E	ANAEROBIC DIGESTION
Air Rotary Drilling with Organic Polymers Of-	ALLUVIAL CHANNELS	Anaerobic Digestion: The Rate-Limiting
fers Many Benefits,	Equations for Resistance to Flow and Sediment	Process and the Nature of Inhibition, W76-05784 5D
W76-05562 8B	Transport in Alluvial Channels,	W76-05784 5D
AIRPORTS	W76-05844 2J	Engineers Can Exert Process Control Over
Quebec's Water and Sewage Masterplan for	ALLUVIAL FAN	Digester Inputs,
Mirabel Region.	Late Pleistocene and Holocene Depositional	W76-05807 5D
W76-05793 5D	Trends, Processes, and History of Astoria	Method and Apparatus for the Anaerobic
ALABAMA	Deep-Sea Fan, Northeast Pacific, W76-05845 2L	Digestion of Decomposable Organic Materials,
Food Habits of the Rough Shiner, Notropis	W 76-03843 2L	W76-05981 5D
Baileyi Suttkus and Raney, in Halawakee	ALPINE	ANALYSIS
Creek, Alabama, W76-06126 2I	Selected Water-Quality Data from Fallen Leaf	The Reliability of Mercury Analysis in En-
W 70-00120 21	Lake, El Dorado County, California, June through October 1974,	vironmental Materials, W76-06007 5A
ALASKA	W76-05848 7C	W76-06007 5A
Evaluation of the Trophic Types of Several		ANALYTICAL TECHNIQUE
Alaskan Lakes by Assessment of the Benthic Fauna,	ALTERNATE FUEL SYSTEMS	Detergent Phosphate Ban Yields Little
W76-05604 5C	Comparative Risk-Cost-Benefit Study of Alter- native Sources of Electrical Energy,	Phosphorus Reduction, Part I, W76-05637 5C
	W76-05829 6B	
Effects of Forest Fertilization on Two Southeast Alaska Streams,	AT PERMANENT DE ANNUE	ANALYTICAL TECHNIQUES Automated Dilution for Measurement of
W76-05612 5C	ALTERNATE PLANNING Economic Magnitudes and Economic Alterna-	Nitrate in Water,
Committee Effections of the Committee	tives in Lower Basin use of Colorado River	W76-05594 5A
Comparative Effectiveness of the Standard Surber Sampler and a Hydraulic Modification	Water,	Stream Analyzers are for Waste as Well as
for Estimating Bottom Fauna Populations,	W76-05811 3A	Product.
W76-05613 7B	ALTERNATIVE PLANNING	W76-05596 . 5A
Nucleation Characteristics of Stream Water	Efficiency in Water Quality Control for the	Assessment of a Stressed Macroinvertebrate
and Frazil Ice Nucleation,	Willamette River,	Community,
W76-05695 2C	W76-05658 5G	W76-05636 5C
The Forest Ecosystem of Southeast Alaska 5.	Decision Making and Planning for River Basin	A Spectral Light Absorption Meter for Mea-
Soil Mass Movement,	Development,	surements in the Sea,
W76-05950 4D	W76-05752 6A	W76-05680 7B
Alaska Oil Pollution Regulations.	South Dakota Environmental Policy Act.	A Technique for Environmental Decision Mak-
W76-06062 5G	W76-06075 5G	ing Using Quantified Social and Aesthetic
ALCORN COUNTY (MC)	Navigable Waters Procedures and Guidelines	Values,
A Rural Mississippi Success Story: Alcorn	for Disposal of Dredged or Fill Material.	W76-05825 5G
County's Water System.	W76-06097 5G	Determination of Selenium in Natural Waters
W76-05657 6D	ALUMINUM	Using the Centrifugal Photometric Analyzer,
ALCAR	Control of Coagulant Recovery from Effluent	W76-06128 2K
Phosphorus, Nitrogen, and the Growth of	Sediment (Kontrol' regeneratsii koagulyantov	ANDRITZ-SEM DEWATERING PRESS
Algae in Lake Kinneret,	iz osadka ctochnykh vod),	Experiences and Possibilities with the Andritz-
W76-05633 5C	W76-05725 5E	Sem Double Wire Press for Sludge Dewatering,
Algal Nitrogen Fixation in Californian Streams:	AMERICAN SAMOA	Particularly in the Paper, Pulp and Board In- dustry (Erfahrungen und Moeglichkeiten mit
Seasonal Cycles,	Submerged Lands Legislation Affecting Guam,	der Andritz-Sem Doppelsiebpresse bei der
W76-05639 5C	The Virgin Islands, and American Samoa (HR 11559).	Schlamment-waesserung, insbesondere in der
Temperature Optimum of Algae Living in the	W76-06080 6E	Papier-, Zellstoff-und Karto W76-05729 5E
Outfall of a Power Plant on Lake Monona,		
W76-06001 5C	AMMONIA NITROGEN	ANDROPOGON-VIRGINICUS
A Note on the Use of Algal Sizes in Estimates	Removal of Ammonia Nitrogen by Catalytic Oxidation Filter Bed (Sesshoku sanka rosho ni	A Non-Adapted Vegetation Interferes with Water Removal in a Tropical Rain Forest Area
of Population Standing Crops,	yoru ammonia-set chisso no jokyo),	in Hawaii,
W76-06043 5A	W76-05589 5D	W76-06042 4A

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ANDROSCOGGIN RIVER BASIN (NH) Availability of Ground Water in the Androscoggin River Basin, Northern New Hampshire, W76-05862 7C	AQUIFER CHARACTERISTICS An Identification Approach to Subsurface Hydrological Systems, W76-05688 2F	ARKANSAS Lingo V. City of Jacksonville (Authority of City to Pump Subterranean Water). W76-06092 6E
ANNAL BEHAVIOR		
ANIMAL BEHAVIOR	Determining Aquifer Coefficients from	ARSENIC
Selector Systems in Recording Physiological	Residual Drawdown Data,	An Automated Technique for the Sub-Micro-
and Behavioral Activity in Sedentary Aquatic	W76-05689 2F	gram Determination of Selenium and Arsenic in
Animals,		Surface Waters by Atomic Absorption Spec-
W76-06039 2I	Floridan Aquifer in Northeast FloridaThree	troscopy,
. WHAT I BARGESTERS	MapsHardness of Water, Chloride Concentra-	W76-05736 SA
ANIMAL PARCESITES	tion, and Potentiometric Surface, May 1974,	
On some Problems of the Biological Control of	W76-05859 7C	ARSENIC COMPOUNDS
Human Schistosomes in Egypt,		An Automated Technique for the Sub-Micro-
W76-06034 5C	Pumping-Test Analysis Using a Discrete Time-	gram Determination of Selenium and Arsenic in
. NIMA A BRINGIO CON	Discrete Space Numerical Method,	Surface Waters by Atomic Absorption Spec-
ANIMAL PHYSIOLOGY	W76-05913 4B	
Selector Systems in Recording Physiological		troscopy, W76-05736 5A
and Behavioral Activity in Sedentary Aquatic	AQUIFER COEFFICIENTS	W 70-03736 3A
Animals,	Determining Aquifer Coefficients from	ARSENICALS (PESTICIDES
W76-06039 21	Residual Drawdown Data,	Effect of Cacodylic Acid and MSMA on
	W76-05689 2F	
ANNUAL INDIAN RAINFALL		Microbes in Forest Floor and Soil,
Trend Analysis of Annual Indian Rainfall,	AQUIFER SYSTEMS	W76-05940 5C
W76-05691 2B	Land Subsidence and Aquifer-System Compac-	
· New Markets of the Control of the	tion in the San Jacinto Valley, Riverside Coun-	ARTESIAN WELLS
ANTIMYCIN A	ty, CaliforniaA Progress Report,	History of Ground Water Development,
Antimycin: Beyond Teleocide,	W76-05847 2F	W76-05556 4B
W76-05662 5C	11 / 0-0304 / 2F	
	AQUIFER TESTING	ARTIFICIAL RECHARGE
ANTITRANSPIRANTS	Portable Water Sampling Apparatus,	Classification of Methods of Groundwater
Detection and Preliminary Identification of En-		Management (Klassificaksiiya metodov
dogenous Antitranspirants in Water-Stressed	W76-05958 7B	upravleniya rezhimom i resursami podzemnykh
Sorghum Plants,	. OUTER	vod),
W76-06026 2I	AQUIFERS	W76-05600 4B
	Perspective 75.	W 70-03000 4B
APPALACHIAN REGIONAL COMMISSION	W76-05651 6B	ARTIFICIALLY GRAVEL-PACKED WELLS
(ARC)		Use of Formation Stabilizer - A Valuable
A Rural Mississippi Success Story: Alcorn	Forecasting Water Levels in Aquifers by Nu-	
County's Water System.	merical and Semihybrid Methods,	Technique,
W76-05657 6D	W76-05686 2F	W76-05564 8A
AQUATIC ANIMALS Selector Systems in Recording Physiological and Behavioral Activity in Sedentary Aquatic Animals,	Geohydrology of the Evangeline and Jasper Aquifers of Southwestern Louisiana, W76-05861 2F	ASIA Maps of the Elements of the Hydrologic Budget of Asia, W76-05934 2A
W76-06039 21	ARCTIC	
	Equilibrium-Line Altitudes, Mass Balance, and	ASPEN
AQUATIC ENVIRONMENT	July Freezing-Level Heights in the Canadian	Response of Soil Testacea to Soil Moisture
Second Annotated Bibliography on Biological	High Arctic,	Fluctuations,
Effects of Metals in Aquatic Environments,	W76-05682 2C	W76-06038 2G
W76-05863 5C		Variable and the second
	AREAL HYDROGEOLOGY	ATLANTIC OCEAN
Environmental Responses to Thermal Discharges from Marshall Steam Station, Lake Norman, North Carolina, W76-05870 5C	Groundwater Study of a Volcanic Area Near Bandung, Java, Indonesia, W76-05914 4B	United States V. Florida (Proceeding Seeking Definition of Seaward Boundary of Submerged Lands of Continental Shelf). W76-06109 6E
	ARID CLIMATES	
Plutonium in Aquatic Biota of the Great Miami	Relation of the Consumptive Use Coefficient to	ATOMIC ABSORPTION ANALYSIS
River Watershed, Ohio,	the Description of Vegetation,	Mercury in Sediments of the Horwer Bucht
W76-05888 5C		(Lake Lucerne) and Tributary Streams, Swit-
W 10 03000	W76-05843 2D	zerland,
AQUATIC LIFE	A DID I A NIDO	
Marine Conservation Act, Amendments.	ARID LANDS	W76-06136 5A
W76-06091 6E	Precipitation Management for Reclamation of	ATTITUDES
	Overgrazed Areas in Arid and Semi-Arid Re-	
AQUATIC MICROORGANISMS	gions,	Sociological Analysis of Dam Impact: A Study
	W76-05603 2B	of Twenty-Two Large Dams in Texas,
Synergistic Compositions Containing 2.2-	110-05005	
Synergistic Compositions Containing 2,2- Dibromo-3-Nitrilopropionamide and 3 3 4 4-		W76-05501 6B
Dibromo-3-Nitrilopropionamide and 3,3,4,4-	ARIZONA	
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide		AUSTRALIA
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use,	ARIZONA	AUSTRALIA The Annual Variation in Yield of Pastures in
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide	ARIZONA Relation of the Consumptive Use Coefficient to	AUSTRALIA
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation,	AUSTRALIA The Annual Variation in Yield of Pastures in
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F AQUATIC POPULATIONS	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation,	AUSTRALIA The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland, W76-06016 3F
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F AQUATIC POPULATIONS Plankton Populations,	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation, W76-05843 2D	AUSTRALIA The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland,
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F AQUATIC POPULATIONS	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation, W76-05843 2D Occurrence of Phytophthora Species and Other Potential Plant Pathogens in Recycled Irrigation	AUSTRALIA The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland, W76-06016 3F
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F AQUATIC POPULATIONS Plankton Populations, W76-05873 5C	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation, W76-05843 2D Occurrence of Phytophthora Species and Other Potential Plant Pathogens in Recycled Irrigation Water,	AUSTRALIA The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland, W76-06016 The Fauna of Careel Bay with Comments on
Dibromo-3-Nitrilopropionamide and 3,3,4,4-Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F AQUATIC POPULATIONS Plankton Populations, W76-05873 5C Benthic Invertebrates,	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation, W76-05843 2D Occurrence of Phytophthora Species and Other Potential Plant Pathogens in Recycled Irrigation	AUSTRALIA The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland, W76-06016 The Fauna of Careel Bay with Comments on the Ecology of Mangrove and Sea-Grass Communities,
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F AQUATIC POPULATIONS Plankton Populations, W76-05873 5C	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation, W76-05843 2D Occurrence of Phytophthora Species and Other Potential Plant Pathogens in Recycled Irrigation Water,	AUSTRALIA The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland, W76-06016 The Fauna of Careel Bay with Comments on the Ecology of Mangrove and Sea-Grass Com-
Dibromo-3-Nitrilopropionamide and 3,3,4,4-Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F AQUATIC POPULATIONS Plankton Populations, W76-05873 5C Benthic Invertebrates, W76-05877 5C	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation, W76-05843 2D Occurrence of Phytophthora Species and Other Potential Plant Pathogens in Recycled Irrigation Water, W76-06010 5C Emory Oak (Quercus Emoryi) Litter Phenolics	AUSTRALIA The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland, W76-06016 The Fauna of Careel Bay with Comments on the Ecology of Mangrove and Sea-Grass Communities,
Dibromo-3-Nitrilopropionamide and 3,3,4,4-Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use, W76-05531 5F AQUATIC POPULATIONS Plankton Populations, W76-05873 5C Benthic Invertebrates,	ARIZONA Relation of the Consumptive Use Coefficient to the Description of Vegetation, W76-05843 2D Occurrence of Phytophthora Species and Other Potential Plant Pathogens in Recycled Irrigation Water, W76-06010 5C	AUSTRALIA The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland, W76-06016 The Fauna of Careel Bay with Comments on the Ecology of Mangrove and Sea-Grass Communities, W76-06022 2L

AUSTRALIA

Effects of a Tropical Cyclone on Littoral and	Microbiological and Chemical Enrichment of	BEACH EROSION
Sub-Littoral Biotic Communities and on a	Freshwater-Surface Microlayers Relative to the	Underwater Wall Structure,
Population of Dugongs (Dugong Dugon	Bulk-Subsurface Water,	W76-05523 8A
(Muller)),	W76-06124 5C	BEDLOAD
W76-06131 2L	Yeasts Isolated from Some Lakes and Rivers	Reservoir Sedimentation Associated with
Seasonal Dynamics and Productivity of Tany-	of Saskatchewan,	Catchment Attributes, Landslide Potential,
tarsus Barbitarsis Freeman	W76-06135 5B	Geologic Faults, and Soil Characteristics,
(Diptera:Chironomidae) in the Benthos of a		W76-05617 4D
Shallow, Saline Lake,	Outbreaks of Waterborne Disease in the United	BEDROCK LITHOLOGY
W76-06142 5C	States, 1971-1972,	Guidelines for Characterizing Naturally Unsta-
Distribution of Fish in Inland Saline Waters in	W76-06138 5C	ble or Potentially Unstable Slopes on Western
Victoria, Australia,	Evaluation of Surface Water Pollution at	National Forests,
W76-06143 2H	Several Points in Relation to Zones of Shellfish	W76-05621 4D
1170-00143	Industry in Roadsteads of the Brest Region, (In	
AUTOANALYZER	French).	BEDS
Automated Dilution for Measurement of	W76-06150 5B	Submerged Lands Legislation Affecting Guam,
Nitrate in Water,		The Virgin Islands, and American Samoa (HR 11559).
W76-05594 5A	BAKER LAKE (WASH)	W76-06080 6E
A TIMOTA A PAGE CONTROL	Table of Data on Water Quality of Baker Lake	W 70-00000
AUTOMATIC CONTROL	near Mount Baker, Washington,	BEHAVIOR
Real-Time Management of Water-Resource	W76-05857 7C	Social Assessment Manual: A Guide to the
Systems,	DIDE	Preparation of the Social Well Being Account,
W76-05747 6A	BARK	W76-05993 6B
Automation Can Be Simple,	Water Pollution in Connection with Bark	
W76-05797 5D	Dumping (Vattenfororeningar i samband med	BEHAVIORAL THERMOREGULATION
	barkdeponering), W76-05726 5B	Developments in Underwater Radiotelemetry
AUTOMATIC SEWER FLOW SAMPLERS	W 76-03726 3B	and Preliminary Fish Tracking in Thermal
An Assessment of Automatic Sewer Flow Sam-	Transfer of Lindane from Bark of Insecticide-	W76-05893 5C
plers - 1975,	Sprayed Pine Pulpwood into Effluent from a	W 70-03893
W76-05864 5D	Barking Drum (Lindaanin huuhtoutumisesta	BENCH MARKS
	suojaruiskutetun mantykuitupuun kuoresta	Flood Hazard Analyses: Blacks Run-Cooks
AUTOMATION	rumpukuorimon jateveteen),	Creek, Rockingham County and Harrisonburg,
Automated Dilution for Measurement of	W76-05734 5B	Virginia.
Nitrate in Water,		W76-05644 4A
W76-05594 5A	BARRAGE PROJECTS	
Automation Can Be Simple,	Technical-Economic Planning of the Gab-	BENEFICIAL USE
W76-05797 5D	cikovo-Nagymaros Barrage Project for the	South Dakota Water Quality Standards.
35	Development of the Central-Danube Basin,	W76-06076 5G
AVAILABLE WATER	W76-05754 4A	BENEFIT MAXIMIZATION
Availability of Ground Water in the Androscog-	BASE FLOW	A Portfolio Approach to Public Water Project
gin River Basin, Northern New Hampshire,	Normal Mode Analysis of the Linear Equation	Decision Making,
W76-05862 7C	of Groundwater Flow,	W76-05995 6B
	W76-05685 2F	
AVERAGE FLOW	W 70-03083 ZF	BENEFITS
The Hydrologic Potential of Unit Areas: A	BASELINE STUDIES	Some Economic and Decision Aspects of the
Basis for Managing Water Resources,	An Ichthyofaunal Survey and Discussion of	Canyon Project, W76-05505 6B
W76-05620 4D	Fish Species Diversity as an Indicator of Water	W76-05505 6B
AXIAL FILTRATION	Quality, Codorus Creek Drainage, York Coun-	BENTH FAUNA
Cross-Flow Filtration and Axial Filtration,	ty, Pennsylvania,	Spatial Dispersion of an Estuarine Benthic Fau-
W76-05788 5D	W76-05634 5A	nal Community,
		W76-06040 2L
BACK RIVER (MARYLAND)	Selected Water-Quality Data from Fallen Leaf	
The Fate of Nutrients in Back River,	Lake, El Dorado County, California, June	BENTHIC FAUNA
W76-05625 5C	through October 1974,	Evaluation of the Trophic Types of Several Alaskan Lakes by Assessment of the Benthic
BACKWACHING	W76-05848 7C	Fauna,
BACKWASHING	Limnological Data for the Major Streams in	W76-05604 5C
Water Purification Apparatus and Timing	Chester County, Pennsylvania,	W 70-03004 SC
Device for Initiating A Backwashing Cycle,	W76-05852 7C	Comparative Effectiveness of the Standard
W76-05968 5F	,,,	Surber Sampler and a Hydraulic Modification
BACTERIA	BASIC DATA COLLECTIONS	for Estimating Bottom Fauna Populations,
Sewage Treatment,	Selected Water-Quality Data from Fallen Leaf	W76-05613 7B
W76-05582 5D	Lake, El Dorado County, California, June	Massakanthia Basulatian Bassaina in Indian
35	through October 1974,	Macrobenthic Population Dynamics in Indiana Waters of Lake Michigan in 1970,
Survival of Escherichia Coli in Stream Water in	W76-05848 7C	W76-05623 5C
Relation to Carbon Dioxide and Plant	Water Bassassas Januari at a second	11 10-03023
Photosynthesis,	Water-Resources Investigations of the U.S.	Assessment of a Stressed Macroinvertebrate
W76-05628 5C	Geological Survey in the Northern Great Plains	Community,
Anaerobic Digestion: The Rate-Limiting	Coal Region of Eastern Montana, 1975-76, W76-05853	W76-05636 5C
Process and the Nature of Inhibition,	W76-05853 7C	The Effect of Ocidina 134 and 14
W76-05784 5D	Hydrogeochemical Data from Investigation of	The Effect of Oxidized Material on the Vertical
30	Water Quality in Sewered and Unsewered	Distribution of Freshwater Benthic Fauna,
Generic Composition and Nutritional Require-	Areas, Southern Nassau County, Long Island,	W76-05743 5C
ments of Bacteria Isolated from Three Lakes,	New York,	Benthic Invertebrates,
W76-06120 2H	W76-05858 7C	W76-05877 SC

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Distribution and Structure of Benthic Assem-	Assessment of a Stressed Macroinvertebrate	BIOMPHALARIA-ALEXANDRINA
blages in Puget Sound, Washington, USA,	Community,	Some Helminths of Bulinus Truncatus and
W76-06015 5B	W76-05636 5C	Biomphalaria Alexandrina from the Irrigation
		System Near Cairo,
BENTHOS	BIOLOGICAL OXYGEN DEMAND	W76-06028 5A
The Effect of Oxidized Material on the Vertical	Modeling the Effect of Waste Discharges in a	P211.1.170
Distribution of Freshwater Benthic Fauna,	Small Mountain Stream,	BIVALVES
W76-05743 5C	W76-05834 5B	Notes on the Biology of Some Estuarine
Generic Composition and Nutritional Paguira	BIOLOGICAL TREATMENT	Bivalves, W76-06134 2L
Generic Composition and Nutritional Require- ments of Bacteria Isolated from Three Lakes,		W76-06134 2L
	Method of Biological Purification of Sewage, W76-05524 5D	BLEACHING WASTES
W76-06120 2H	W76-05524 5D	Lab-Proven Fly Ash Process Removes Bleach
BETAINES	Wastewater Treatment,	Effluent Color,
Use of Polymeric Quaternary Ammonium	W76-05579 5D	W76-05707 5D
Betaines as Water Clarifiers,	W 70-05579	W 10-03101
W76-05544 5F	Waste Water and Sewage Treatment.	Electrolytic Coagulation of Lignin from Kraft
W /0-03344 3F	W76-05580 5D	Mill Bleach Plant Wastewaters,
BIBLIOGRAPHIES		W76-05708 5D
Social Impact Assessment: An Analytic	Biomass Distribution and Kinetics of Baffled	
Bibliography,	Lagoons,	Effect of Bleached Kraft Mill Effluent on the
W76-05820 6B	W76-05590 5D	Survival of Starved Juvenile Coho Salmon
W 70-03820		(Oncorhynchus Kisutch),
Second Annotated Bibliography on Biological	For Which Load Shall Municipal Purification	W76-05710 5C
Effects of Metals in Aquatic Environments,	Plants be Dimensioned. (Fuer Welche	
W76-05863 5C	Belastung Sollen Kommunale Klaeranlagen	Bleach Plant Pollution Abatement Where Do
11.0.0000	Bemessen Werden),	We Stand,
BIG CYPRESS SWAMPS (FLA)	W76-05609 5D	W76-05719 5D
Differential Responses to Drought in Two Spe-	30	D. L. C. C. P. C.
cies of Fundulus,	Influence of Temperature on Biological Purifi-	Reduction of Effluent Volume and Fresh Water
W76-06132 2H	cation of Paper Mill Effluent (Influenza della	Consumption (Snizhenie ob'ema ctochnykh
1170-00132 ZH	temperatura sulla depurazione biologica di un	vod i raskhoda svezhej vody),
BIG SIOUX RIVER (S.DIOWA)	refluo di cartiera),	W76-05727 3E
Report on Water Quality and Waste-Source In-	W76-05700 5D	DITTE OF A CIEB OWA CIE
	W 70-03700	BLUE GLACIER (WASH)
vestigations, Big Sioux River and Selected	Symposium on Water Purification (Symposium	Some Observations on the Behavior of the
Tributaries.	over vattenrening).	Liquid and Gas Phases in Temperate Glacier
W76-05626 5C	W76-05711 5D	Ice,
BIOASSAY	W70-03711	W76-05915 2C
	Biological Treatment by a System of Activated	BONE MEAT
Statistical Study of the Duckweed Rhizosphere	Sludge Applied to the Effluent Waters of a	BONE MEAL
as an Eco-Assay Tool,	Corrugated Board Plant,	Behaviour of Some Phosphatic Fertilizers in
W76-05605 5B	W76-05713 5D	Water,
Compositive Toxicity of Polyelectrolytes to	W 10 03 113	W76-06139 5B
Comparative Toxicity of Polyelectrolytes to	Process Biodegradable Effluent Underground.	BOREHOLE FLUID BEHAVIOR
Selected Aquatic Animals,	W76-05776 5D	Careful Sample Taking is Key to Successful
W76-05740 5C		
BIOCHEMICAL OXYGEN DEMAND	Biological Denitrification and its Application in	Wells, W76-05560 4B
	Treatment of High-Nitrate Waste Water,	W76-05560 4B
Demand for Dissolved Oxygen Exerted by	W76-05792 5D	BOREHOLE SHAVINGS
Finely Divided Logging Debris in Streams,		Careful Sample Taking is Key to Successful
W76-05939 4C	Biological Nitrification of Sludge Supernatant	Wells,
DIOCHEMICAL DESCRIONS	by Rotating Disks,	W76-05560 4B
BIOCHEMICAL REACTIONS	W76-05800 · 5D	W 70-03300 4B
Process for Biochemical Reactions,		BOTTOM SAMPLING
W76-05542 5D	Wastewater Treatment Evaluation, Mt. Hebo	Comparative Effectiveness of the Standard
BIOCHEMISTRY	Air Force Station, Oregon,	Surber Sampler and a Hydraulic Modification
BIOCHEMISTRY	W76-05802 5D	for Estimating Bottom Fauna Populations,
Productivity and Biochemical Composition of		W76-05613 7B
Chlorella at Different Levels of Illumination	Wastewater Treatment,	10 00015 /B
and Nitrogen Limitation,	W76-05961 5D	BOUNDARIES (PROPERTY)
W76-05640 5C		Submerged Lands Legislation Affecting Guam,
NICEPEGE I PARTICULA	Method for the Primary and Secondary Treat-	The Virgin Islands, and American Samoa (HR
BIODEGRADATION	ment of Wastewater in a Unitary Apparatus,	11559).
Biodegradation of Methanolic Waste Water,	W76-05972 5D	W76-06080 6E
W76-05525 5D		17 73 00000 OE
BIOINDIG LEONG	BIOMASS	State V. Griffith (Private Claim to Tidelands).
BIOINDICATORS	Nutrient Cycling in 37- and 450-Year-Old	W76-06087 6E
Statistical Study of the Duckweed Rhizosphere	Douglas-Fir Ecosystems,	
as an Eco-Assay Tool,	W76-05619 5B	BOUNDARY DISPUTES
W76-05605 5B		State V. Griffith (Private Claim to Tidelands).
	Effect of Environmental Factors on Standing	W76-06087 6E
Evaluation of Surface Water Pollution at	Crop of Plankton in British Columbia Lakes,	
Several Points in Relation to Zones of Shellfish	W76-05741 5C	United States V. Florida (Proceeding Seeking
Industry in Roadsteads of the Brest Region, (In		Definition of Seaward Boundary of Submerged
French),	Benthic Invertebrates,	Lands of Continental Shelf).
W76-06150 5B	W76-05877 5C	W76-06109 6E
BIOLOGICAL COMMINTERS	DIOM A CO DIOMNINIMANA	
BIOLOGICAL COMMUNITIES	BIOMASS DISTRIBUTIONS	BOUNDARY PROCESS
Macrobenthic Population Dynamics in Indiana	Biomass Distribution and Kinetics of Baffled	Chemically Enhanced C02 Gas Exchange in a
Waters of Lake Michigan in 1970,	Lagoons,	Eutrophic Lake: A General Model,
W76-05623 5C	W76-05590 5D	W76-05635 5C

SUBJECT INDEX

CAM W CAM H R C W Ti W W CAP E of Ca W

CAR W W CAL Si ta V W CAL E in ni p W

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CA T ti

CA E

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CE

BOUNDARY WATERS TREATY OF 1909

BOUNDARY WATERS TREATY OF 1909 The International Law Aspects of the Garrison	Chemical Characterization of Fiber Building	and Depreciation of Property Value-Inverse Condemnation).
Diversion Project,	Board Mill Effluent,	W76-06112 6E
W76-06053 6E	W76-05731 5A	CANADA
Congress Orders Moritorium on Garrison	BUILDING CODES	CANADA Yukon City's New Well Replaces Five Older
Diversion Unit.	Certain Land Use Regulations to Protect from	Ones,
W76-06054 6E	Danger of Flooding.	W76-05566 4B
BRACKISH WATER	W76-06059 6F	Subsurface Disposal of Liquid Industrial
Brackish-Water Phytoplankton Response to	BULINUS-TRUNCATUS	Wastes,
Temperature Elevation,	Some Helminths of Bulinus Truncatus and	W76-05573 5B
W76-05999 5C	Biomphalaria Alexandrina from the Irrigation	
BREEDING	System Near Cairo, W76-06028 5A	Quality and Variation of Pollutant Loads in Urban Stormwater Runoff,
Breeding Places and Seasonal Incidence of	W 70-00020	W76-05576 5B
Aedes Aegypti, as Assessed by the Single- Larva Survey Method,	BULLHEADS	
W76-06033 5G	Fecundity of the Brown Bullhead, Ictalurus Nebulosus (Le Sueur) in a Mine Acid Polluted	Hanlon Creek Ecological Study, Phase B.
PETONO	River,	W76-05650 6G
BRICKS Experiments on the Optimization of Sludge De-	W76-05641 8I	Collapse of the Hudson Bay Ice Center and
watering and on the Use of Bark and Sludge in	BURNING	Glacio-Isostatic Rebound,
the Brick Industry (Versuche Zur Optimierung	Soil Stability and Water Yield and Quality,	W76-05669 2C
der Schlammentwaesserung und zur Verwer-	W76-05937 4D	Development of Oxygen Deficits in 14
tung von Rinde und Schlamm in der Ziegelin- dustrie),	CA CODY IC A CID	Southern Ontario Lakes,
W76-05704 5D	Effect of Cacodylic Acid and MSMA on	W76-05679 5C
	Microbes in Forest Floor and Soil,	Equilibrium-Line Altitudes, Mass Balance, and
BRIDGES	W76-05940 5C	July Freezing-Level Heights in the Canadian
City of Los Angeles V. Ricards (Flood Destruc- tion of Private Bridge Causes Loss of Access	CALCARPOUS SOILS	High Arctic,
and Depreciation of Property Value-Inverse	CALCAREOUS SOILS Effect of Surface Applied Sulfuric Acid on	W76-05682 2C
Condemnation).	Water Penetration into Dry Calcareous and	Effect of Environmental Factors on Standing
W76-06112 6E	Sodic Soils,	Crop of Plankton in British Columbia Lakes,
Lanning V. State Highway Commission (Flood	W76-05907 5G	W76-05741 5C
Damage by Debris Collected in Front of Bridge	CALCIUM	
Piers).	Studies on the Ca, Mg, and Sr Content of	The Thermal Regime of Trapridge Glacier and
W76-06113 6E	Freshwater Clamshells,	Its Relevance to Glacier Surging, W76-05916 2C
BRINE DISPOSAL	W76-06119 2H	
Subsurface Disposal of Liquid Industrial	CALIFORNIA	Interpreting Stability Problems for the Land
Wastes,	How Steam Is Produced and Handled at the	Manager, W76-05947 4D
W76-05573 5B	Geysers,	W 76-03947 4D
BROMEGRASS	W76-05574 8C	Canadian Water Resources Information: A
Ratio Between Evapotranspiration from	The Hydrologic Potential of Unit Areas: A	Network Approach,
Lysimeters and Evaporation from Small Evaporimeters Using 2- and 3- hour Periods of	Basis for Managing Water Resources,	W76-05952 10D
Measurement,	W76-05620 4D	Influences of Some Freshwater Plants on the
W76-06029 2D	Water Factory 21 is the Future,	Development and Survival of Mosquito Larvae
BROWN BULLHEAD	W76-05782 5F	in British Columbia,
Fecundity of the Brown Bullhead, Ictalurus	Land Subsidence and Aquifer-System Compac-	W76-06048 5G
Nebulosus (Le Sueur) in a Mine Acid Polluted	tion in the San Jacinto Valley, Riverside Coun-	The International Law Aspects of the Garrison
River,	ty, CaliforniaA Progress Report,	Diversion Project,
W76-05641 . 8I	W76-05847 2F	W76-06053 6E
BRUSH CONTROL	Selected Water-Quality Data from Fallen Leaf	Congress Orders Moritorium on Garrison
Dicamba Residues in Streams After Forest	Lake, El Dorado County, California, June	Diversion Unit.
Spraying,	through October 1974,	W76-06054 6E
W76-05949 5B	W76-05848 7C	Yeasts Isolated from Some Lakes and Rivers
BRYOPHYTES	Subtidal Marine Biology of California, with	of Saskatchewan,
Notes on the Production of Stream Bryophytes	Emphasis on the South,	W76-06135 5B
in the High Pyrenees (France), W76-06129 21	W76-06023 2L.	CANVON DAM (PRVAC)
	State Water Quality Control Fund.	CANYON DAM (TEXAS) Some Economic and Decision Aspects of the
BUBBLES	W76-06063 5G	Canyon Project,
Water Purified by Electroflotation for Rapid Sedimentation and Clean Clarified Water.	Clean Water Grant Program.	W76-05505 6B
W76-05766 SD	W76-06064 5D	CANNON LAND (MONAGE
		CANYON LAKE (TEXAS) An Evaluation of Some Recreational, Demo-
Some Observations on the Behavior of the Liquid and Gas Phases in Temperate Glacier	Waste Discharge Reports and Requirements. W76-06065	graphic and Economic Impacts of Canyon
Ice,		Lake,
W76-05915 2C	Certification of Conformance with Water	W76-05506 6B
BUFFALO RIVER (VA)	Quality Standards.	CANYON RESERVOIR (TEX)
Flood Hazard Analyses: Buffalo River, Am-	W76-06066 5G	Sociological Analysis of Dam Impact: A Study
herst County, Virginia.	City of Los Angeles V. Ricards (Flood Destruc-	of Twenty-Two Large Dams in Texas,
W76-05643 4A	tion of Private Bridge Causes Loss of Access	W76-05501 6B

rse 6E der 4B rial

5B

6G and 2C 14 5C and ian 2C ing 5C and 2C and 4D A 0D the vae 5G son 6E son 6E ers 5B the 6B

noon 6B

idy 6B

Coping with Flood Hazard in New Braunfels and Seguin, Texas, W76-05502 6F	The Chemical Speciation of PU-239, PU-240 and CS-137 in Lake Michigan Waters,	Biological Treatment by a System of Activated Sludge Applied to the Effluent Waters of a Corrugated Board Plant,
THE PROPERTY OF THE PROPERTY OF	W76-05889 5B	W76-05713 5D
CANYON RESERVOIR (TEXAS) Hydrologic Implications of Canyon Dam and Reservoir,	Effect of Municipal Treatment Processes on PU-239, PU-240, and CS-137,	Silver in Photoprocessing Effluents, W76-05732 5D
W76-05503 2H	W76-05890 5F	Profession of Companies Profession Plant Pf
	Effect of Plume Residence on the Accumula-	Purification of Gum Rosin Producing Plant Ef- fluents from Resinous Substances (Ochistka
The Impact of Canyon Dam and Reservoir on Wildlife, W76-05504 6G	tion of Cs137 by Lake Michigan Salmonids, W76-05902 5C	stochnykh vod kanifol'noterpentinnogo proiz- vodstva ot smolistykh veshchestv),
11,00000		W76-05735 5D
CAPE COD (MASS)	CESIUM-137	Apparatus for the Treatment of Liquid Wastes,
Evaluation of Data Availability and Examples of Modeling for Ground-Water Management on Cape Cod, Massachusetts,	Fallout CS-137: A Tool in Conservation Research, W76-05690 2J	W76-05967 5D
W76-05856 4B		Purification of Waste Water Containing Phthal- ic Esters.
,	CHANCE-CONSTRAINED PROGRAMMING Reservoir Management Via Reliability Pro-	W76-05982 5D
CAPITAL COSTS	gramming,	
Minimizing the Operating and Capital Costs of	W76-05508 4A	Outbreaks of Waterborne Disease in the United States, 1971-1972,
Water Supply Projects, W76-05522 6A		W76-06138 5C
W/0-05522	CHANNELS	
CARASSIUS-CARASSIUS	Discharge Equations for HS, H, and HL Flumes.	CHESTER COUNTY (PA) Limnological Data for the Major Streams in
Studies on the Effects of Copper on the Lac-	W76-05918 8B	Chester County, Pennsylvania,
tate Dehydrogenase and Esterase Isozymes in Various Tissues of Carassius Carassius,	CHEH OR A CEVI HO MA CROPERRIO	W76-05852 7C
W76-05595 5C	CHEILODACTYLUS-MACROPTERUS Food of Tarakihi in Western Bay of Plenty and	CHICAGO (ILL)
	Tasman Bay, New Zealand,	Biological Nitrification of Sludge Supernatant
CARBOHYDRATES	W76-06047 2L	by Rotating Disks,
Environmental Aspects of the Use of Starches		W76-05800 5D
in the Paper Industry (Hlediska ochrany zivot- niho prostredi pri pouzivani skrobovych	CHEMCONTROL	CHILE
produktu v papirenskem prumyslu),	Dicamba Residues in Streams After Forest Spraying,	CHILE Siphon System Yields Chilean Plant More
W76-05720 5B	W76-05949 5B	Water.
		W76-05550 8C
Seasonal Variation in Dissolved Carbohydrate	CHEMICAL ANALYSIS	CHILKA LAKE (INDIA)
(DCHO) Content in Three Freshwater Ponds, W76-06117 2H	Hydrogeochemical Data from Investigation of Water Quality in Sewered and Unsewered	Observations on the Seasonal Fluctuations of
W 70-00117 2H	Areas, Southern Nassau County, Long Island,	Plankton in the Chilka Lake,
CARBON DIOXIDE	New York,	W76-06118 2H
Survival of Escherichia Coli in Stream Water in	W76-05858 7C	CHLORELLA
Relation to Carbon Dioxide and Plant	CHEMICAL BRUSH CONTROL	Productivity and Biochemical Composition of
Photosynthesis, W76-05628 5C	Dicamba Residues in Streams After Forest Spraying,	Chlorella at Different Levels of Illumination and Nitrogen Limitation,
Chemically Enhanced C02 Gas Exchange in a	W76-05949 5B	W76-05640 5C
Eutrophic Lake: A General Model,	CHEMICAL OVECON DEMAND	CHLORIDES
W76-05635 5C	CHEMICAL OXYGEN DEMAND Rapid Determination of the Cod of Effluents	Floridan Aquifer in Northeast FloridaThree
Carbon Dioxide Evolution from Virgin and Cul-	(Uskorennoe opredelenie KhPK stochnykh	MapsHardness of Water, Chloride Concentra-
tivated Soil as Affected by Management Prac-	vod),	tion, and Potentiometric Surface, May 1974,
tices and Climate,	W76-05705 5A	W76-05859 7C
W76-06003 2G	CHEMICAL PRECIPITATION	Ionic Leaf Accumulation in Grapes, Guava and
CAREEL BAY (AUSTRALIA)	Chemical Precipitation of Wastewaters with	Olive Plants as Affected by the Salinity of Ir-
The Fauna of Careel Bay with Comments on	Lime (Kemisk fallning av avloppsvatten med	rigation Water, W76-06030 3C
the Ecology of Mangrove and Sea-Grass Com-	kalk),	W /6-06030
munities,	W76-05585 5D	CHLORINATED PHENOLS
W76-06022 2L	Awt Plant is Top Performer,	Ion Exchange Technique for the Determination
CARP	W76-05769 5D	of Chlorinated Phenols and Phenoxy Acids in Organic Tissue, Soil, and Water,
Biology and Bioenergetics of Grass Carp	Law Cast Phaenharava Pamaval	W76-06122 5A
(Ctenopharyngodon Idella Val.),	Low Cost Phosphorous Removal,	
W76-06013 2I	W76-05786	CHI OBINI TION
	W76-05786 5D	CHLORINATION Pollution Control System for Water Supply
CENTRIFUGAL DEWATERING	CHEMICAL REACTIONS	CHLORINATION Pollution Control System for Water Supply, W76-05530 SF
CENTRIFUGAL DEWATERING Lime Use in Wastewater Treatment: Design	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Waste-	Pollution Control System for Water Supply, W76-05530 5F
Lime Use in Wastewater Treatment: Design and Cost Data,	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Wastewaters,	Pollution Control System for Water Supply, W76-05530 5F CITIZEN PARTICIPATION
Lime Use in Wastewater Treatment: Design	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Waste-waters, W76-05597 SD	Pollution Control System for Water Supply, W76-05530 5F CITIZEN PARTICIPATION A Rural Mississippi Success Story: Alcorn
Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 5D	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Wastewaters, W76-05597 CHEMICAL SLUDGE PROCESSING	Pollution Control System for Water Supply, W76-05530 5F CITIZEN PARTICIPATION
Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 5D CENTRIFUGATION	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Wastewaters, W76-05597 CHEMICAL SLUDGE PROCESSING Lime Use in Wastewater Treatment: Design	Pollution Control System for Water Supply, W76-05530 5F CITIZEN PARTICIPATION A Rural Mississippi Success Story: Alcorn County's Water System. W76-05657 6D
Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 5D	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Wastewaters, W76-05597 CHEMICAL SLUDGE PROCESSING Lime Use in Wastewater Treatment: Design and Cost Data,	Pollution Control System for Water Supply, W76-05530 5F CITIZEN PARTICIPATION A Rural Mississippi Success Story: Alcorn County's Water System. W76-05657 6D
Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 5D CENTRIFUGATION Method and Apparatus for Centrifugally Separating Finely Divided Solids from Aqueous Suspensions Thereof,	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Wastewaters, W76-05597 5D CHEMICAL SLUDGE PROCESSING Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 5D	Pollution Control System for Water Supply, W76-05530 SF CITIZEN PARTICIPATION A Rural Mississippi Success Story: Alcorn County's Water System. W76-05657 6D
Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 5D CENTRIFUGATION . Method and Apparatus for Centrifugally Separating Finely Divided Solids from Aqueous	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Wastewaters, W76-05597 SD CHEMICAL SLUDGE PROCESSING Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 SD CHEMICAL WASTES	Pollution Control System for Water Supply, W76-05530 5F CITIZEN PARTICIPATION A Rural Mississippi Success Story: Alcorn County's Water System. W76-05657 6D CLAMS Antimycin: Beyond Teleocide, W76-05662 5C
Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 5D CENTRIFUGATION Method and Apparatus for Centrifugally Separating Finely Divided Solids from Aqueous Suspensions Thereof,	CHEMICAL REACTIONS Lime-Induced Reactions in Municipal Wastewaters, W76-05597 5D CHEMICAL SLUDGE PROCESSING Lime Use in Wastewater Treatment: Design and Cost Data, W76-05868 5D	Pollution Control System for Water Supply, W76-05530 5F CITIZEN PARTICIPATION A Rural Mississippi Success Story: Alcorn County's Water System. W76-05657 6D CLAMS Antimycin: Beyond Teleocide,

C

CLARIFICATION CHAMBERS

CLARIFICATION CHAMBERS	COAGULANTS	COASTAL ZONES
Water Clarification Settler.	Control of Coagulant Recovery from Effluent	Coastal Zone Management Program Develop-
W76-05578 5F	Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod),	ment Grant.
CLASSIFICATION	W76-05725 5E	W76-06095 6E
Plastics and Synthetics Point Source Category	11.0 05.125	CODONELLA CRATERA
(Proposed Effluent Limitations and	COAGULATION	Vertical Transport of Particulate Material in
Guidelines).	Processing of Sediments from Coagulation Ap-	Lake Michigan by the Lorica of Codonella
W76-06086 5G	plied as the Third Stage of Effluent Purification (Przerabianie osadow powstajacych przy	Cratera,
	zastosowaniu koagulacji jako trzeciego stopnia	W76-05881 5C
Environmental Protection Agency-Poultry	oczyszczania sciekow z przemyslu włokiennic-	CODORUS CREEK (PA.)
Processing Products, Proposed Performance and Pretreatment Standards.	zego),	An Ichthyofaunal Survey and Discussion of
W76-06096 5G	W76-05697 5D	Fish Species Diversity as an Indicator of Water
	Electrolytic Coagulation of Lignin from Kraft	Quality, Codorus Creek Drainage, York Coun-
Navigable Waters Procedures and Guidelines	Mill Bleach Plant Wastewaters,	ty, Pennsylvania, W76-05634 5A
for Disposal of Dredged or Fill Material.	W76-05708 5D	W 70-03034 3A
W76-06097 5G	Ontimizing Organic Corbon and Colon Removal	COHO SALMON
CLAYS	Optimizing Organic Carbon and Color Removal from a Board Mill Effluent,	Sensitivity of Blood Cell Counts in Juvenile
Interactions of Mercury with Aquatic and	W76-05724 5D	Coho Salmon (Oncorhynchus Kisutch) to Stres-
Edaphic Environments,		sors Including Sublethal Concentrations of Pulp Mill Effluent and Zinc,
W76-05601 5B	Control of Coagulant Recovery from Effluent	W76-05696 5C
	Sediment (Kontrol' regeneratsii koagulyantov	W 70-03070
Carbon Dioxide Evolution from Virgin and Cul-	iz osadka ctochnykh vod), W76-05725 5E	Effect of Bleached Kraft Mill Effluent on the
tivated Soil as Affected by Management Prac-	W 10-03123	Survival of Starved Juvenile Coho Salmon
tices and Climate, W76-06003 2G	COAL MINE WASTES	(Oncorhynchus Kisutch),
W 70-00003	Impact of Coal Strip Mining on Water Quality	W76-05710 5C
The Performance of Surface and Sub-Surface	and Hydrology of East Tennessee,	COLLECTION FACILITIES (SHIPS)
Drainage of Heavy Clay Soils in Yugoslavia,	W76-05833 5B	Port Collection and Separation Facilities for
W76-06116 2G	COAL MINES	Oily Wastes. Vol. 5. A Comparative Analysis of
	Water-Resources Investigations of the U.S.	Conceptual System Plans for the Surveyed
CLEAN STREAMS LAW	Geological Survey in the Northern Great Plains	Ports Under the 'No Discharge', '1969 Amend-
Commonwealth, Department of Natural	Coal Region of Eastern Montana, 1975-76,	ments' and 'No Sheen' Criteria,
Resources V. Westmoreland-Fayette Municipal Sewage Authority (Appeal by Municipal Entity	W76-05853 7C	W76-05830 5D
from Order to Curb Discharge of Untreated	Northern Great Plains Resource Program.	COLOR
Sewage into Waters of Pennsylvania.,	W76-06050 6D	Use of Ion Exchangers and Synthetic Sorbents
W76-06115 6E		for Removal of Color from Kraft Process ef-
or and the same of	COASTAL ENGINEERING	fluents (Proby zastosowania jonitow i sor-
CLEANING	Conditional Expected Tsunami Inundation for Hawaii,	bentow syntetycznych do usuwania barwy ze
Rig Restoration.	W76-05920 8B	sciekow posiarczanosych), W76-05698 5D
W76-05555 8G		W 70-03098
Regulations Pertaining to Oil Spills into Public	COASTAL PLAINS	Lab-Proven Fly Ash Process Removes Bleach
Waters.	Pine Management Influences the Southern	Effluent Color,
W76-06071 5G	Water Resource, W76-05616 5B	W76-05707 5D
	W 70-03010	COLORADO
CLEAR-CUTTING	Vertical Electrical Resistivity Soundings to	An Economic Analysis of Water Use in
Impact of Clear-Cutting and Road Construction	Locate Ground Water Resources: A Feasibility	Colorado's Economy,
on Soil Erosion by Landslides in the Western	Study,	W76-05837 6B
Cascade Range, Oregon,	W76-05835 4B	
W76-05614 4C	Sediment Characteristics of Streams in the	Upper Harmony Ditch Co. V. Carwin
CLIMATES	Eastern Piedmont and Western Coastal Plain	(Treasurer's Deed Incapable of Extinguishing Ditch Easement and Water Rights Under War-
Carbon Dioxide Evolution from Virgin and Cul-	Regions of North Carolina,	ranty Deed).
tivated Soil as Affected by Management Prac-	W76-05849 2J	W76-06101 6E
tices and Climate,	Harvesting Southern Forests: A Threat to	
W76-06003 2G	Water Quality,	COLORADO RIVER
Climatic Water Put and Wi	W76-05945 5B	Economic Magnitudes and Economic Alterna-
Climatic Water Balance at Hissar, W76-06041 2B	COACTAL CERUCTURES	tives in Lower Basin use of Colorado River Water,
W76-06041 2B	COASTAL STRUCTURES Underwater Wall Structure,	W76-05811 3A
CLOUD PHYSICS	W76-05523 8A	
Detachment of Pendant Water Drops by High		Principal Economic Aspects of the Problem of
Voltage Pulses,	COASTAL ZONE MANAGEMENT	Salinity of the Colorado River,
W76-05917 2B	The Washington Shoreline Management Act, W76-06056	W76-05821 6E
CLOUD SEEDING	W76-06056 5G	COLORADO RIVER STORAGE PROJECT ACT
Field Observations of the Persistence of AgI-	COASTAL ZONE MANAGEMENT ACT	OF 1956
NH4I-Acetone Ice Nuclei in Daylight,	Coastal Zone Management Program Develop-	Legislative Bargain and the Doctrine of Repea
W76-05677 3B	ment Grant.	by Implication (Discussion of Case Involving
	W76-06095 6E	Colorado River Storage Act). W76-06052 4A
CLUSTER WELLS	COASTAL ZONE MANAGEMENT ACT OF 1972	, 3-00032 4A
How Steam Is Produced and Handled at the	Coastal Zone Management and Intergovern-	COLUMBIA BASIN PROJECT
Geysers, W76-05574 8C	mental Coordination,	The Columbia Basin Project Reappraised,
W76-05574 8C	W76-06057 6E	W76-05750 4A

E

in la

of er n-

A

le s-

C ie in

of d

D

ts fr-

D h

in B

in g

E

A of

g

COLUMBIA RIVER	COMPUTER PROGRAMS	CONSUMPTIVE USE
The Columbia Basin Project Reappraised,	Steady-State Segmented Dissolved-Oxygen	
W76-05750 4A	Model, W76-05855 5B	Colorado's Economy, W76-05837 6B
Late Pleistocene and Holocene Depositional		W 10-03037
Trends, Processes, and History of Astoria Deep-Sea Fan, Northeast Pacific,	COMPUTERS Toronto's Approach to Preventive Maintenance	Relation of the Consumptive Use Coefficient to the Description of Vegetation,
W76-05845 2L	for Treatment Plants,	W76-05843 2D
COMBINED SEWERS	W76-05780 5F	CONTROL
Sewer Flow Measurement - A State-Of-The-Art	CONDENSATION	A Case Study Report on the Vistula River
Assessment,	How Steam Is Produced and Handled at the	Basin,
W76-05865 5D	Geysers,	W76-05514 4A
	W76-05574 8C	
COMBINED TREATMENT	Desalination Apparatus.	Water Management Control System for the
Combined Waste Treatment Proves Economi- cal and Feasible.	W76-05959 3A	Zagyva-Tarna River Basin,
W76-05787 5D	77,0 03737	W76-05746 4A
35	CONFERENCES	CONTROL SYSTEMS
COMMUNICATION	Symposium on Water Purification (Symposium	Detection Devices for Use in Solution
Structuring Communications Programs for	over vattenrening),	Processing Systems,
Public Participation in Water Resources	W76-05711 5D	W76-05532 5F
Planning, W76-05652 6B	CONFINEMENT PENS	This Plant Can Use 5 Sludge Processes,
W 70-03032 6B	Confined Animal Feeding or Holding Opera-	W76-05798 5D
COMMUNITY DEVELOPMENT	tions.	
Perspective 75.	W76-06072 5G	CONVERTING PLANTS (PAPER
W76-05651 6B	CONIFEROUS FORESTS	PROCESSORS)
COMPACTION	Nutrient Cycling in 37- and 450-Year-Old	Biological Treatment by a System of Activated
Land Subsidence and Aquifer-System Compac-	Douglas-Fir Ecosystems,	Sludge Applied to the Effluent Waters of a Corrugated Board Plant,
tion in the San Jacinto Valley, Riverside Coun-	W76-05619 5B	W76-05713 5D
ty, CaliforniaA Progress Report,	COMPAGNATION TO B	
W76-05847 2F	Institutional Constraints and Conjunctive	COORDINATION
	Management of Water Resources in West	Coastal Zone Management and Intergovern-
COMPETING USES	Texas,	mental Coordination,
Multi-Objective Water Resources Planning: Methodology to Achieve Compatibility	W76-05842 6E	W76-06057 6E
Methodology to Achieve Compatibility Between Environmental Amenities and		COPEPODS
Economic Development,	CONNECTICUT RIVER	Role of Copepod Fecal Pellets in the Vertical
W76-05840 6B	Criteria for Evaluation of Social Impacts of	Transport of Freshwater Diatoms,
	Flood Management Alternatives, W76-05653 6B	W76-05880 5C
COMPREHENSIVE PLANNING	11 70 03033	Observations on the Second Photostics of
Urban Water Management of an International	CONSERVATION	Observations on the Seasonal Fluctuations of Plankton in the Chilka Lake,
River: The Case of El Paso -Juarez, W76-05661 3D	To Amend the Wild and Scenic Rivers Act (on	W76-06118 2H
W 70-03001 3D	S. 10 and S. 1004).	
The Czechoslovak Water Development	W76-06081 6E	COPPER
Planning Approach and Its Application,	Marine Conservation Act, Amendments.	Studies on the Effects of Copper on the Lac-
W76-05749 6A	W76-06091 6E	tate Dehydrogenase and Esterase Isozymes in Various Tissues of Carassius Carassius,
Utah's Third Year of Planning for the Four	CONSTITUTIONAL LAW	W76-05595 SC
Corners Regional Commission,	The Taking Issue: Potential Obstacle to natural	11.0-05575
W76-05827 6B	Resource Management Legislation,	Removal of Copper and Iron Prior to Water
	W76-06055 6E	Hardness Titration,
Coastal Zone Management and Intergovern-		W76-05716 5A
mental Coordination, W76-06057 6E	Oliver V. Hyle (Termination of Water and Sewer Services for Failure to Pay Arrearages	CORES
W/0-0003/	Denial of Due Process).	Distribution of Diatom Frustules in Lake
COMPUTER MODELS	W76-06094 6E	Michigan Sediment Cores,
QUURM - A Realistic Urban Runoff Model,		W76-05882 5C
W76-05577 2A	CONSTRUCTION	Distribution of Amorphous, Diatom Frustule,
Normal Mode Analysis of the Linear Equation	Impacts of Hydrologic Modification on Water	and Dissolved Silica in a Lead-210 Dated Core
of Groundwater Flow,	Quality, W76-05866 5G	from Southern Lake Michigan,
W76-05685 2F	W 70-03800	W76-05883 5C
	CONSTRUCTION COSTS	
Development and Field Testing of a Basin	Costs as a Guide to Pricing,	Stable Lead Geochronology of Fine-Grained
Hydrology Simulator,	W76-05570 6C	Sediments in Southern Lake Michigan, W76-05884 5B
W76-05745 2A	Optimal Design Model for Waste Water Collec-	
Modeling the Effect of Waste Discharges in a	tion System (II) (Gesuidokan kiyo keikaiu no	CORROSION CONTROL
Small Mountain Stream,	saitekika moderu to sono oyo (II)),	Rig Restoration.
W76-05834 5B	W76-05598 5D	W76-05555 8G
Evaluation of Data Availability and Examples	Clean Water Grant Program.	COST ALLOCATION
of Modeling for Ground-Water Management on	W76-06064 5D	Financing the New Water Authorities,
Cape Cod, Massachusetts,		W76-05810 6C
W76-05856 4B	CONSTRUCTION MATERIALS	
Pesticide Residue Dynamics in a Forest	Alignment of Longitudinally Acrating Acration	Criteria for Evaluation of Social Impacts of
Ecosystem: A Compartment Model,	Tanks (Naladka aerotankov prodlennoy aerat- sii),	Criteria for Evaluation of Social Impacts of Flood Management Alternatives,
W76-05946 5B	W76-05587 5D	W76-05653 6B

SUBJECT INDEX

Aqu Sys W70

Buf Der W7

Det Pro W7

Mu Wa W7

Des Ele W7

Me W7

DENI Ver in I Nit W7

Bio Tre W7

DEN! A sur W7

DEPC Re Ca Ge W7 DEPC Aq Sys

DESA Bu De W7

De W7

Me De Fre W7

Mu Wa Wa Wa Wa

De Ele W7

Op Wr W7

DESA De W7

COST-BENEFIT ANALYSIS

Efficiency in Water Quality Control for the Willamette River,	CURRENT METERS Line Motion and Water Current Disc Sensor,	Effective Use of High Water Table Areas for Sanitary Landfill. Vol. II,
W76-05658 5G	W76-05539 7B	W76-05744 5G
Economic Magnitudes and Economic Alterna- tives in Lower Basin use of Colorado River	CURRENTS (WATER) Line Motion and Water Current Disc Sensor,	DATA SCARCITY River Basin Models and Their Application with
Water,	W76-05539 7B	Scarcity of Data.
W76-05811 3A	Estimate of the Rate of Turbulent Mixing of	W76-05516 4A
Benefit and Cost Analysis of Hydrological Forecasts,	the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog-	DATA STORAGE AND RETRIEVAL Social Science Data Banks and the Institute for
W76-05823 6B	raphy, W76-05932 8B	Water Resources, W76-05822 6B
Evaluation of Economic Benefits for Flood	W 70-03932	
Control and Water Resource Planning. W76-06083 4A	CYCLING NUTRIENTS Nutrient Cycling in 37- and 450-Year-Old Douglas-Fir Ecosystems,	DATA TRANSMISSION Developments in Underwater Radiotelemetry and Preliminary Fish Tracking in Thermal
COST-BENEFIT RATIO	W76-05619 5B	Plumes,
A Portfolio Approach to Public Water Project Decision Making,	The Fate of Nutrients in Back River,	W76-05893 5C
W76-05995 6B	W76-05625 5C	DDT
COST PERSONNESS ABBROACH		Limnological Character of Experimental Reser-
COST-EFFECTIVENESS APPROACH Long Range Planning of Water Resources: A	Soil Microbes, W76-05935 2G	voirs Treated with Tritox 30% (DDT, DMDT, GAMMA HCH),
Multi Objective Approach,	w 76-03933 2G	W76-06012 5C
W76-05760 6A	CYCLONES	
COST MINIMIZATION	Effects of a Tropical Cyclone on Littoral and	The Forest Ecosystem of Southeast Alaska 5.
Minimizing the Operating and Capital Costs of	Sub-Littoral Biotic Communities and on a Population of Dugongs (Dugong Dugon	Soil Mass Movement,
Water Supply Projects,	(Muller)),	W76-05950 4D
W76-05522 6A	W76-06131 2L	DECISION MAKING
COST REPAYMENT	CYTOLOGICAL OTUDIES	Some Economic and Decision Aspects of the
Industrial Cost Recovery and User Charge As-	CYTOLOGICAL STUDIES Phosphorus, Nitrogen, and the Growth of	Canyon Project,
sessments,	Algae in Lake Kinneret,	W76-05505 6B
W76-05813 5G	W76-05633 5C	Environmental Considerations in River Basin
COSTS	Productivity and Biochemical Composition of	Planning and Decision Making,
An Evaluation of the Use of Gamma Radiation	Chlorella at Different Levels of Illumination	W76-05510 4A
in Sewage Treatment,	and Nitrogen Limitation,	Uncertainty in Water Resources Decision Mak-
W76-05803 5D	W76-05640 5C	ing,
Comparative Risk-Cost-Benefit Study of Alter-	CZECHOSLOVAKIA	W76-05513 6A
native Sources of Electrical Energy,	Study of Turbine Mixers for Flow-Through	Decision Making and Planning for River Basin
W76-05829 6B	Flocculation Chambers (Vyzkum turbinovych	Development,
The Economics of Clean Water. Volume III.	michadel pro prutocne flokulacni komory), W76-05703 5D	W76-05752 6A
Industry Expenditures for Water Pollution		Multipurpose River Project Planning in the
Abatement.	The Czechoslovak Water Development	Lower Mekong Basin: A Decision Approach,
W76-05951 5G	Planning Approach and Its Application, W76-05749 6A	W76-05762 6A
State Financial Assistance to Public Agencies		Willingness to Pay as a Behaviourial Criterion
for Pollution Control Facilities.	DAMS	for Environmental Decision-Making,
W76-06073 5G	Seismic Instrumentation of Dams, W76-05667 8D	W76-05826 5G
COULOMETRY	W 70-05007	Environmental Impact Assessment as an In-
A Coulometric Device for Measuring Total Ox-	DANUBE RIVER	strument of Public Policy for Controlling
ygen Demand, W76-05728 5A	Technical-Economic Planning of the Gab- cikovo-Nagymaros Barrage Project for the	Economic Growth,
	Development of the Central-Danube Basin,	W76-05828 6G
COUNCIL OF ENVIRONMENTAL QUALITY	W76-05754 4A	Reforming Procedures for Industrial Siting,
Reforming Procedures for Industrial Siting, W76-06058 6E	DANUBE RIVER BASIN	W76-06058 6E
W 70-00036	Legal Framework of Co-Operation in the Field	DEEP SHAFT AERATION PROCESS
CROOKED HOLES	of Water Management Between Hungary and	Process Biodegradable Effluent Underground.
Simple Procedures Can Help Reduce Drill Pipe Damage,	Her Neighboring Countries,	W76-05776 5D
W76-05572 8C	W76-05759 6E	DEEP-WELL INJECTION
	DAPHNIA	Subsurface Disposal of Liquid Industrial
CROP PRODUCTION The Append Veristics in Vield of Postures in	Comparative Toxicity of Polyelectrolytes to	Wastes,
The Annual Variation in Yield of Pastures in the Seasonally Dry Tropics of Queensland,	Selected Aquatic Animals, W76-05740 5C	W76-05573 5B
W76-06016 3F		DEEP WELLS
	DATA ACQUISITION	Exploitation of the Waters of Subpermafrost
Effect of Different Methods of Planting in Pud- dled Soil on the Yield of Rice,	River Basin Models and Their Application with Scarcity of Data.	Artesian Basins,
W76-06017 3F	W76-05516 4A	W76-05930 3B
		DEHYDRATION
CROSS FLOW FILTRATION Cross-Flow Filtration and Axial Filtration.	DATA COLLECTIONS Percents and Drilling Percents	Overwintering of Evergreens in Plastic Struc-
W76-05788 5D	Records and Drilling Reports. W76-05557 6A	tures, W76-06014 21
	UA	41

or iG th iA

ry al iC

T,

5. D

he B in

A in A

A n

E

1

DELTAS	Method and Apparatus for Desalinization of	Flood Loss Management in Developing Coun-
Aquifer Evaluation Using Depositional	Water,	tries: A Model for Identifying Appropriate
Systems: An Example in North-Central Texas, W76-05554 2F	W76-05979 3A	Strategies, W76-05761 6A
	Apparatus for the Separation of Liquid Mix-	
DEMINERALIZATION Buffered, Weak Ion-Exchange Water	tures My Means of Permeability Selective	Water Resources Development in the Ganga-
Demineralization Process,	Separation Membranes, W76-05991 3A	Ghagra Interbasin in Uttar Pradesh (India), W76-05763
W76-05526 3A	W 70-03771 3A	# 10-03/03
	DESALINATION PLANTS	DEVELOPING ECONOMIES
Detection Devices for Use in Solution	Economic Magnitudes and Economic Alterna-	Water Resources Development in the Tisza
Processing Systems, W76-05532 5F	tives in Lower Basin use of Colorado River	River Basin and Its Impact on Socio-Economic
W 70-03332	Water, W76-05811 3A	Growth,
Multistage Flash Evaporator for Producing Soft	W76-05811 3A	W76-05519 4A
Water from a Saline Water,	DESALINATION PROCESSES	DEWATERING
W76-05978 3A	Method of Preventing Scale From Being	Experiences and Possibilities with the Andritz-
Desalination Process by Improved Multistage	Deposited In Case of Producing Fresh Water	Sem Double Wire Press for Sludge Dewatering,
Electrodialysis.	From Sea Water,	Particularly in the Paper, Pulp and Board In-
W76-05980 3A	W76-05971 3A	dustry (Erfahrungen und Moeglichkeiten mit
V 4-1-10	Reverse Osmosis Separation Apparatus,	der Andritz-Sem Doppelsiebpresse bei der Schlamment-waesserung, insbesondere in der
Method of Operating Ion Exchange System, W76-05983 5F	W76-05990 3A	Papier-, Zellstoff-und Karto
W 70-03763		W76-05729 5E
DENITRIFICATION	DESERT PLANTS	
Vertical Distribution of Nitrate Concentration	Eco-Physiological Studies on Desert Plants: IX.	Sludge Dewatering Trials at Banbury,
in Interstitial Water of Marine Sediments with	Types of Transpiration Curves of Zilla Spinosa Prantl Under Natural Conditions,	W76-05809 5D
Nitrification and Denitrification,	W76-06123 2D	Lime Use in Wastewater Treatment: Design
W76-05678 5B	W 70 00125	and Cost Data,
Biological Denitrification and its Application in	DESIGN	W76-05868 5D
Treatment of High-Nitrate Waste Water,	A Review of Some Hydrological Studies	
W76-05792 5D	Required in the Design of Water Management	DIATOMS
DENMARK	Projects. W76-05517 4A	Role of Copepod Fecal Pellets in the Vertical
A Spectral Light Absorption Meter for Mea-	W76-05517 4A	Transport of Freshwater Diatoms, W76-05880 5C
surements in the Sea,	Design, Operation, and Monitoring of Mu-	W 70-03000
W76-05680 7B	nicipal Irrigation Systems,	Vertical Transport of Particulate Material in
PERCENTION	W76-05783 5E	Lake Michigan by the Lorica of Codonella
DEPOSITION Reservoir Sedimentation Associated with	DESIGN CRITERIA	Cratera, W76-05881 5C
Catchment Attributes, Landslide Potential,	Design and Operation of High-Rate Filters-	W76-05881 5C
Geologic Faults, and Soil Characteristics,	Part 2,	Distribution of Diatom Frustules in Lake
W76-05617 4D	W76-05831 5D	Michigan Sediment Cores,
DEBOCKSTON AT CHOSENAG		W76-05882 5C
DEPOSITIONAL SYSTEMS Aquifer Evaluation Using Depositional	Design and Operation of High-Rate Filters-	Observations on the Seasonal Fluctuations of
Systems: An Example in North-Central Texas,	Part 3, W76-05832 5F	Plankton in the Chilka Lake,
W76-05554 2F	W 70-03032	W76-06118 2H
	DESIGN STANDARDS	
DESALINATION	Road Standards on Steep Terrain in the Pacific	DICAMBA
Buffered, Weak Ion-Exchange Water	Northwest U.S.A. with Suggestions for Imple-	Dicamba Residues in Streams After Forest
Demineralization Process, W76-05526 3A	mentation,	Spraying, W76-05949 5B
W 70-03520	W76-05948 4C	W 76-03749 3B
Desalination Apparatus,	DESORPTION	DIELDRIN
W76-05959 3A	Interactions of Mercury with Aquatic and	Accumulation and Elimination of Dieldrin by
Method of Preventing Scale From Being	Edaphic Environments,	Channel Catfish (Ictalurus Punctatus),
Deposited In Case of Producing Fresh Water	W76-05601 5B	W76-05642 5C
From Sea Water,	DETERGENTS	DIPTERA
W76-05971 3A	Detergent Phosphate Ban Yields Little	The Effect of Oxidized Material on the Vertical
Multistans Elech Eugenstan for Bradusine Soft	Phosphorus Reduction, Part I,	Distribution of Freshwater Benthic Fauna,
Multistage Flash Evaporator for Producing Soft Water from a Saline Water,	W76-05637 5C	W76-05743 5C
W76-05978 3A	n 1 1 n	The Effects of Size-Selection Predation and
	Removal of Detergent Fluorescent Whitening Agents from Waste Water,	Environmental Variation on the Distribution
Method and Apparatus for Desalinization of	W76-05804 5D	and Abundance of a Chironomid, Paraborniella
Water, W76-05979 3A		Tonnoiri Freeman,
11 /10-037/7	DEUTERIUM	W76-06130 21
Desalination Process by Improved Multistage	Isotopic Study of Hail,	Consend Dunamies and Burdenstein & The
Electrodialysis,	W76-05665 2B	Seasonal Dynamics and Productivity of Tany- tarsus Barbitarsis Freeman
W76-05980 3A	DEVELOPING COUNTRIES	(Diptera:Chironomidae) in the Benthos of a
Operation of Pilot Plant LTV Evaporator at	Ex-Post Evaluation of River Basin Develop-	Shallow, Saline Lake,
Wrightsville Beach, North Carolina.	ments in Pakistan,	W76-06142 5C
W76-06049 3A	W76-05748 6A	DICCHARCE (WATER)
DESALINATION APPARATUS	International Management of the River Plate	DISCHARGE (WATER) Discharge Equations for HS, H, and HL
Desalination Apparatus,	Basin.	Flumes,
W76-05959 3A	W76-05756 4A	W76-05918 8B

SUBJECT INDEX

DRA E: W

DRI Ir Q W

DR V

DR

DR

DR

Di

D

D

D

D

D

DISCHARGE (WATER)

South Dakota Water Quality Standards. W76-06076 5G	The Effects of Size-Selection Predation and Environmental Variation on the Distribution	Canadian Water Resources Information: A Network Approach,
DISINFECTION	and Abundance of a Chironomid, Paraborniella	W76-05952 10D
Pollution Control System for Water Supply,	Tonnoiri Freeman, W76-06130 2I	DOGLEGS
W76-05530 5F	Distribution of Fish in Inland Saline Waters in	Simple Procedures Can Help Reduce Drill Pipe Damage,
DISPERSION	Victoria, Australia,	W76-05572 8C
A Stochastic Model of Dispersion of Sediment	W76-06143 2H	Manager and the second
Particles Released from A Continuous Source, W76-05663 2J	DISTRIBUTION PATTERNS	DOMESTIC ANIMALS Confined Animal Feeding or Holding Opera-
Spatial Dispersion of an Estuarine Benthic Fau-	A Stochastic Model of Dispersion of Sediment Particles Released from A Continuous Source,	tions. W76-06072 5G
nal Community, W76-06040 2L	W76-05663 2J	
1170-00040	The Effect of Ovidinal Metarial on the Vertical	DOMESTIC WASTES
DISPOSAL Waste Discharge Reports and Requirements.	The Effect of Oxidized Material on the Vertical Distribution of Freshwater Benthic Fauna,	Process and Equipment for Automatic Chemi- cal-Biological Wastewater Treatment with
W76-06065 5G	W76-05743 5C	Provisions for Recycle and Reuse, W76-05955 5D
DISSOLVED OXYGEN	Plankton Populations,	
Waste Water and Sewage Treatment.	W76-05873 5C	Method for the Primary and Secondary Treat-
W76-05580 5D	Distribution and Structure of Benthic Assem-	ment of Wastewater in a Unitary Apparatus, W76-05972 5D
Modeling the Effect of Waste Discharges in a	blages in Puget Sound, Washington, USA,	W 70-03772
Small Mountain Stream,	W76-06015 5B	DOUGLAS FIR TREES
W76-05834 5B	DISTRIBUTION SYSTEMS	Nutrient Cycling in 37- and 450-Year-Old
Steady-State Segmented Dissolved-Oxygen	PVC Pipe in Water Distribution: Reliability and Durability,	Douglas-Fir Ecosystems, W76-05619 5B
Model, W76-05855 5B	W76-05552 8G	Impact of Forest Fertilization on Water Quality
	W-4	in the Douglas-Fir Region A Summary of
Fisheries Research, W76-05878 5C	Water's Most Efficient System. W76-05655 6C	Monitoring Studies, W76-05943 5B
		W76-05943 5B
Demand for Dissolved Oxygen Exerted by	DITCHES	DRAINAGE
Finely Divided Logging Debris in Streams, W76-05939 4C	Bartley V. Sone (Right of Individual to the Use of Spring Waters Located Wholly on His Land	Illinois Drainage LawThe Dominant Estate Owner May Not Increase the Rate or Amount
Water On Par St. 1 1 O. GWALL 1	for Any Purpose).	of Surface Water Run-Off onto the Servient
Water Quality Standards: Oregon (Withdrawal of Proposed Rule Making).	W76-06099 6E	Estate Beyond a Range Consistent with a Pol-
W76-06098 5G	Upper Harmony Ditch Co. V. Carwin (Treasurer's Deed Incapable of Extinguishing	icy of Reasonable Use, W76-06051 4A
DISSOLVED SOLIDS	Ditch Easement and Water Rights Under War-	11 10 00031
Effect of Environmental Factors on Standing	ranty Deed).	DRAINAGE AREA
Crop of Plankton in British Columbia Lakes, W76-05741 5C	W76-06101 6E	Relationships Between Drainage Area Charac- teristics and Non-Point Source Nutrients in
W 10-05/41	DIVERSION	Streams.
DISTILLATION	Illinois Drainage LawThe Dominant Estate	W76-05624 5B
Operation of Pilot Plant LTV Evaporator at	Owner May Not Increase the Rate or Amount	
Wrightsville Beach, North Carolina. W76-06049 3A	of Surface Water Run-Off onto the Servient	DRAINAGE EFFECTS Estimate of the Effect of Flood-Plain Drainage
	Estate Beyond a Range Consistent with a Pol- icy of Reasonable Use,	on the Annual and Maximum Runoff of Small
DISTRIBUTION Trace Element, Mineralogy, and Size Distribu-	W76-06051 4A	Rivers in the Ukraine (Dnieper Basin), W76-05676 4A
tion of Suspended Material Samples from	Congress Orders Moritorium on Garrison	W76-05676 4A
Selected Rivers in Eastern Kansas, W76-05606 5B	Diversion Unit.	Caldwell V. Goldberg (Discharge of Effluent from Sewage Plant into Drainage Ditch).
Distribution of Amorphous, Diatom Frustule,	W76-06054 6E	W76-06093 6E
and Dissolved Silica in a Lead-210 Dated Core	Shaub V. Fifth Judicial District (Adjudication	Buston V. Donales Courts (Courts V. 1.19)
from Southern Lake Michigan,	of Water Rights in Main Stream Also an Adju- dication of Rights in Tributaries),	Burton V. Douglas County (County Liability for Flood Damages to Property Caused by
W76-05883 5C	W76-06104 6E	Faulty Road Construction).
Geochronology of Lake Michigan Sediments:	Butler V. Bruno (Deflection of Surface	W76-06105 6E
Anomalies in Lead-210 Distributions, W76-05885 5B	Waters).	DRAINAGE SYSTEMS
	W76-06110 6E	Caldwell V. Goldberg (Discharge of Effluent
Sedimentary Pu-239, Pu-240 Phase Distribu- tions in Lake Michigan Sediments,	DMDT	from Sewage Plant into Drainage Ditch). W76-06093 6E
W76-05891 5B	Limnological Character of Experimental Reservoirs Treated with Tritox 30% (DDT, DMDT,	Wilber V. Western Properties (Whether an Ar-
The Distribution of Plutonium in Lake	GAMMA HCH),	tificially Altered Watercourse is a Natural or
Michigan Sediments,	W76-06012 5C	Artificial Channel a Matter of Law). W76-06103
W76-05892 5B	DNIEPER RIVER BASIN (USSR)	W 10-00103
Effects of Season, Location, and Discharge	Estimate of the Effect of Flood-Plain Drainage	DRAINAGE WATER
Type on Fish Distribution and Density in Ther-	on the Annual and Maximum Runoff of Small	Solute Travel-Time Estimates for Tile-Draine
mal Plumes, W76-05896 5C	Rivers in the Ukraine (Dnieper Basin), W76-05676 4A	Fields: I. Theory, W76-05904 5E
Correction of Bias in the Estimation of the	DOCUMENTATION	Solute Travel-Time Estimate for Tile-Drained
Coefficient of Skewness, W76-05910 2E	Records and Drilling Reports. W76-05557 6A	Fields: II. Application to Experimental Studies. W76-05905
2E	W76-05557 6A	W76-05905

10D II Pipe 8C

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DRAWDOWN Efficient Wells Save Energy and Reduce Costs,	DROUGHT TOLERANCE Differential Responses to Drought in Two Spe-	Relation of Water Level and Fish Availability
W76-05563 4B	cies of Fundulus, W76-06132 2H	to Wood Stork Reproduction in the Southern Everglades, Florida, W76-05850 21
Determining Aquifer Coefficients from	· w /0-00132 2H	W76-05850 2I
Residual Drawdown Data, W76-05689 2F	DROUGHTS Regional Water Exchange for Drought Allevia-	Radiological and Environmental Research Divi- sion Annual Report - Ecology, January-
DREDGING	tion,	December 1974.
Impacts of Hydrologic Modification on Water	W76-05819 4A	W76-05879 5C
Quality, W76-05866 5G	DUCKWEED Statistical Study of the Duckweed Rhizosphere	ECONOMETRICS Detailed Economic Models for Industrial and
	as an Eco-Assay Tool,	Other Activities,
Corps Issues Interim Rules for Discharges of	W76-05605 5B	W76-05817 5G
Dredged and Fill Materials. W76-06061 5G	Phosphorus Removal from Static Sewage Ef-	
W 76-00001	fluent Using Duckweed,	ECONOMIC DEVELOPMENT
Navigable Waters Procedures and Guidelines for Disposal of Dredged or Fill Material.	W76-05775 5D	Multi-Objective Water Resources Planning: Methodology to Achieve Compatibility
W76-06097 5G	DUE PROCESS	Between Environmental Amenities and
	Commonwealth, Department of Natural	Economic Development,
DRIFT CURRENT	Resources V. Westmoreland-Fayette Municipal	W76-05840 6B
Wind Effects on Stream Flows, W76-05921 2E	Sewage Authority (Appeal by Municipal Entity	ECONOMIC FEASIBILITY
W76-05921 2E	from Order to Curb Discharge of Untreated	Regional Water Exchange for Drought Allevia-
DRILL HOLES	Sewage into Waters of Pennsylvania.,	tion.
Experimental Well Field is Put to Many Uses,	W76-06115 6E	W76-05819 4A
W76-05569 8G	DUGONGS	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	Effects of a Tropical Cyclone on Littoral and	A Portfolio Approach to Public Water Project
DRILL PIPE FAILURE	Sub-Littoral Biotic Communities and on a	Decision Making,
Simple Procedures Can Help Reduce Drill Pipe	Population of Dugongs (Dugong Dugon	W76-05995 6B
Damage, W76-05572 8C	(Muller)),	ECONOMIC CROWTH
W76-05572 8C	W76-06131 2L	ECONOMIC GROWTH Environmental Impact Assessment as an In-
DRILLERS LOGS	DYES	strument of Public Policy for Controlling
Records and Drilling Reports.	Biological Treatment of Dyes,	Economic Growth,
W76-05557 6A	W76-05737 5D	W76-05828 6G
Careful Sample Taking is Key to Successful	Treatment of Dye Wastes With Granular Ac-	ECONOMIC IMPACT
Wells,	tivated Carbon,	Sociological Analysis of Dam Impact: A Study
W76-05560 4B	W76-05738 5D	of Twenty-Two Large Dams in Texas,
A Driller's Good Friend - The Electric Logger,		W76-05501 6B
W76-05561 8G	DYNAMICS	
	Macrobenthic Population Dynamics in Indiana Waters of Lake Michigan in 1970,	An Evaluation of Some Recreational, Demo-
DRILLING	W76-05623 5C	graphic and Economic Impacts of Canyon Lake.
History of Ground Water Development,	11 10 03023	W76-05506 6B
W76-05556 4B	Seismic Instrumentation of Dams,	W 70-05500
Records and Drilling Reports.	W76-05667 8D	Perspective 75.
W76-05557 6A	E. COLI	W76-05651 6B
	Survival of Escherichia Coli in Stream Water in	
Simple Procedures Can Help Reduce Drill Pipe Damage,	Relation to Carbon Dioxide and Plant	Measuring and Minimizing the Social Cost of Environmental Pollution,
W76-05572 8C	Photosynthesis,	W76-05824 5G
	W76-05628 5C	
DRILLING EQUIPMENT	EASEMENTS	Environmental Impact Assessment as an In-
Rig Restoration.	Upper Harmony Ditch Co. V. Carwin	strument of Public Policy for Controlling
W76-05555 8G	(Treasurer's Deed Incapable of Extinguishing	Economic Growth, W76-05828 6G
Simple Procedures Can Help Reduce Drill Pipe	Ditch Easement and Water Rights Under War-	W76-05828 6G
Damage,	ranty Deed).	ECONOMIC PREDICTION
W76-05572 8C	W76-06101 6E	Evaluation of Economic Benefits for Flood
DRIVE AND STATES	Story V. Hefner (Deeds Purporting to Divide	Control and Water Resource Planning.
DRILLING FLUIDS Air Rotary Drilling with Organic Polymers Of-	Lake in Half Ineffective to Prohibit Use of En-	W76-06083 4A
fers Many Benefits,	tire Surface for Recreational Purposes).	
W76-05562 8B	W76-06102 6E	ECONOMICS
		Optimal Design Model for Waste Water Collec-
DRILLING RIGS	EAST RIVER (NY)	tion System (II) (Gesuidokan kiyo keikaiu no saitekika moderu to sono oyo (II)),
Rig Restoration.	Effects of Salinity on Nitrification in the East	W76-05598 5D
W76-05555 8G	River, W76-05631 5C	A second of the second
DRILLING SAMPLES		Technical-Economic Planning of the Gab-
Careful Sample Taking is Key to Successful	ECOLOGICAL DISTRIBUTION	cikovo-Nagymaros Barrage Project for the
Wells,	Macrovegetation and Ecological Factors in	Development of the Central-Danube Basin,
W76-05560 4B	Two Norwegian Lakes,	W76-05754 4A
DROPS (FLUIDS)	W76-06044 5C	Flood Loss Management in Developing Coun-
Detachment of Pendant Water Drops by High	ECOLOGY	tries: A Model for Identifying Appropriate
Voltage Pulses,	Hanlon Creek Ecological Study, Phase B.	Strategies,
W76-05917 2B	W76-05650 6G	W76-05761 6A

ECONOMICS

Evaluation of Quality Parameters in Water Resource Planning: A State-of-the-Art Survey of the Economics of Water Quality,	ELECTROMAGNETIC FLOWMETERS Flowmeter for an Open Aqueduct, W76-05540 7B	ENGLAND Financing the New Water Authorities, W76-05810 6C
W76-05818 5G	BLUMBUM BALLING	
A A A A A A A A A A A A A A A A A A A	EMINENT DOMAIN	ENOLA (PA)
ECOSYSTEMS	The Taking Issue: Potential Obstacle to natural	Sediment Characteristics of Five Streams Near
Lake Wingra, 1837-1973: A Case History of	Resource Management Legislation,	Harrisburg, Pennsylvania, Before Highway
Human Impact,	W76-06055 6E	Construction,
W76-05997 5C	Lingo V. City of Jacksonville (Authority of	W76-05854 4C
EFFECTS	City to Pump Subterranean Water). W76-06092 6E	ENTRAINMENT (PLANKTON)
Evaluation of the Effects of Water Transfer,	W 76-00092 0E	Primary Production,
W76-05751 6A	City of Los Angeles V. Ricards (Flood Destruc-	W76-05874 5C
PERFEIRMO	tion of Private Bridge Causes Loss of Access	Zacalanktan Entrainment
EFFLUENTS	and Depreciation of Property Value-Inverse	Zooplankton Entrainment, W76-05876 5C
Rapid Determination of the Cod of Effluents	Condemnation).	W /6-038/6
(Uskorennoe opredelenie KhPK stochnykh	W76-06112 6E	ENVIRONMENT
vod),		Detailed Economic Models for Industrial and
W76-05705 5A	Goose Creek Hunting Club, Inc. V. United	Other Activities.
Control of Coagulant Recovery from Effluent	States (Damages for Government's Taking of	W76-05817 5G
	Permanent Flowage Easement).	W 70-03617
Sediment (Kontrol' regeneratsii koagulyantov	W76-06114 6E	Willingness to Pay as a Behaviourial Criterion
iz osadka ctochnykh vod),		for Environmental Decision-Making,
W76-05725 5E	EMPLOYMENT	W76-05826 5G
Solute Travel-Time Estimates for Tile-Drained	An Economic Analysis of Water Use in	
	Colorado's Economy,	ENVIRONMENT EFFECTS
Fields: I. Theory,	W76-05837 6B	Deposit of Motor Vehicle Bodies and Accesso-
W76-05904 5B		ries into the Waters of the State.
Solute Travel-Time Estimate for Tile-Drained	EMULSIONS	W76-06070 5G
	Emulsion Breaking Method,	
Fields: II. Application to Experimental Studies,	W76-05527 5G	ENVIRONMENTAL CONTROL
W76-05905 5B		Management of Environmental Quality: Obser-
EGYPT	ENERGY	vations on Recent Experience in the United
	Apparatus and Method for Extracting Wave	States and the United Kingdom,
Some Helminths of Bulinus Truncatus and	Energy,	W76-05659 5G
Biomphalaria Alexandrina from the Irrigation	W76-05538 8C	11 70-03037
System Near Cairo,		Deposit of Motor Vehicle Bodies and Accesso-
W76-06028 5A	Wave-Action Power Apparatus,	ries into the Waters of the State.
ELECTRIC POWER	W76-05549 8C	W76-06070 5G
Proposal for a Trans-Mediterranean Aqueduct,	Energy Requirements for Conventional and	ENVIRONMENTAL EFFECTS
W76-05660 4A	Advanced Wastewater Treatment,	Environmental Considerations in River Basin
ELECTRIC POWER PRODUCTION	W76-05702 5D	Planning and Decision Making,
	ENERGY CONSERVATION	W76-05510 4A
Comparative Risk-Cost-Benefit Study of Alter-		
native Sources of Electrical Energy,	Efficient Wells Save Energy and Reduce Costs, W76-05563 4B	Precipitation Management for Reclamation of
W76-05829 6B	W76-05563 4B	Overgrazed Areas in Arid and Semi-Arid Re-
ELECTRIC WELL LOGGING	ENERGY CONVERSION	gions,
A Driller's Good Friend - The Electric Logger,	Water Current Power Generator System,	W76-05603 2B
	W76-05537 8C	
W76-05561 8G	W 70-03337	How to Guide Growth in Southeastern New
ELECTRICAL POWER PRODUCTION	Apparatus and Method for Extracting Wave	England, Parts I, II and IV of the Draft Report.
ERDA's Tiger Lagoon Program to Probe New	Energy,	W76-05649 6G
	W76-05538 8C	
Energy Source.		Environmental Impact Assessment as an In-
W76-05568 8A	Wave-Action Power Apparatus,	strument of Public Policy for Controlling
ELECTRICAL PROPERTIES	W76-05549 8C	Economic Growth,
The Permittivity and Attenuation in		W76-05828 6G
Polycrystalline and Single-Crystal Ice Ih at 30	ERDA's Tiger Lagoon Program to Probe New	Commenter Pick Co. 1. P. C. C. 1.
and 60 MHz,	Energy Source.	Comparative Risk-Cost-Benefit Study of Alter-
W76-05672 2C	W76-05568 8A	native Sources of Electrical Energy,
W 70-05072		W76-05829 6B
ELECTRODIALYSIS	How Steam Is Produced and Handled at the	Salastad Water Oveller Date from Faller I and
Desalination Process by Improved Multistage	Geysers,	Selected Water-Quality Data from Fallen Leaf
Electrodialysis,	W76-05574 8C	Lake, El Dorado County, California, June
W76-05980 3A	ENERGY COST REDUCTION	through October 1974,
3A		W76-05848 7C
ELECTROFLOTATION	Yukon City's New Well Replaces Five Older Ones,	Relation of Water Level and Fish Availability
Water Purified by Electroflotation for Rapid	The second secon	to Wood Stork Reproduction in the Southern
Sedimentation and Clean Clarified Water.	W76-05566 4B	
W76-05766 5D	ENERGY LOSS	Everglades, Florida, W76-05850
30	Comparative Estimate of Energy Losses in	W76-05850 21
ELECTROLYSIS	Bodies of Water, and Quiet and Turbulent	Environmental Responses to Thermal
Electrolytic Coagulation of Lignin from Kraft	Flows.	Discharges from Marshall Steam Station, Lake
Mill Bleach Plant Wastewaters,	W76-05924 8B	Norman, North Carolina,
W76-05708 5D	11.5-03724 BB	W76-05870 5C
30	ENFIELD CREEK (NY)	11 13-03010
Water Purified by Electroflotation for Rapid	Stream Bed Stabilization in Enfield Creek,	Thermal and Water Quality Characteristics of
Sedimentation and Clean Clarified Water.	New York,	Lake Norman.
W76-05766 5D	W76-06145 8I	W76-05872 SC

6C Near hway 4C

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Basin 4A n of Re-2B

New oort. 6G Inlling 6G lter-6B Leaf June 7C ility hern 21 rmal ake 5C s of

5C

W76-05873 5C	ENVIRONMENTAL IMPACT ASSESSMENT	ESTIMATING
1110 03013	Structuring Communications Programs for	
Primary Production,	Public Participation in Water Resources	Recreation. Vol. II of V. Estimating Initial
W76-05874 5C	Planning, W76-05652 6B	Reservoir Recreation Use, W76-05611 6B
The Effect of Thermal Discharge on the Rate	PANTE CANADATA I MARA CE CE A ESTADA	Balanda Bar Walks of The
of Accumulation of Organic Substances on	ENVIRONMENTAL IMPACT STATEMENT	Estimating Dry Weight of Live,
Glass Surfaces Immersed in Lake Norman,	How to Guide Growth in Southeastern New	Unanesthetized Fish by Photography, W76-05615 5A
W76-05875 5C	England, Parts I, II and IV of the Draft Report. W76-05649	W76-05615 5A
	W76-05649 6G	The Application of Sequential Estimation
Zooplankton Entrainment,	ENVIRONMENTAL IMPACT STATEMENTS	Methods to Counts of Phytoplankton,
W76-05876 5C	South Dakota Environmental Policy Act.	W76-05622 5A
B 41 7 41 4	W76-06075 5G	
Benthic Invertebrates,	107	Estimate of the Effect of Flood-Plain Drainage
W76-05877 5C	ENVIRONMENTAL PROTECTION	on the Annual and Maximum Runoff of Small
Fisheries Research,	Measuring and Minimizing the Social Cost of	Rivers in the Ukraine (Dnieper Basin),
W76-05878 5C	Environmental Pollution,	W76-05676 4A
W 70-05070	W76-05824 5G	An Passamia Analysis of Water Has in
Role of Copepod Fecal Pellets in the Vertical		An Economic Analysis of Water Use in
Transport of Freshwater Diatoms,	ENVIRONMENTAL QUALITY	Colorado's Economy, W76-05837 6B
W76-05880 5C	Willingness to Pay as a Behaviourial Criterion	W /6-0383/
	for Environmental Decision-Making,	Correction of Bias in the Estimation of the
Vertical Transport of Particulate Material in	W76-05826 5G	Coefficient of Skewness,
Lake Michigan by the Lorica of Codonella	PANTE ON A PART OF A PART	W76-05910 2E
Cratera,	ENVIRONMENTAL QUALITY (EQ)	11.000210
W76-05881 5C	Management of Environmental Quality: Obser-	Using Parametric Models of Runoff to Improve
B1.3.4. 4 B1. B1.4. 4 F1.	vations on Recent Experience in the United	Parameter Estimates for Stochastic Models,
Distribution of Diatom Frustules in Lake	States and the United Kingdom,	W76-05911 2E
Michigan Sediment Cores,	W76-05659 5G	
W76-05882 5C	EQUATIONS	Comparative Estimate of Energy Losses in
Distribution of Amorphous, Diatom Frustule,		Bodies of Water, and Quiet and Turbulent
and Dissolved Silica in a Lead-210 Dated Core	Equations for Resistance to Flow and Sediment Transport in Alluvial Channels.	Flows,
from Southern Lake Michigan,		W76-05924 8B
W76-05883 5C	W76-05844 2J	
11 70-03003	EQUILIBRIUM-LINE ALTITUDES	Estimate of the Rate of Turbulent Mixing of
Stable Lead Geochronology of Fine-Grained	Equilibrium-Line Altitudes, Mass Balance, and	the Fluid in Wind-Driven Currents from the
Sediments in Southern Lake Michigan,	July Freezing-Level Heights in the Canadian	Results of Moving and Still Particle Photog-
W76-05884 5B	High Arctic,	raphy,
	W76-05682 2C	W76-05932 8B
Geochronology of Lake Michigan Sediments:	170-03002	PETIMATING POLIATIONS
Anomalies in Lead-210 Distributions,	EQUIPMENT EVALUATION	ESTIMATING EQUATIONS
W76-05885 5B	Sewer Flow Measurement - A State-Of-The-Art	The Application of Sequential Estimation
	Assessment,	Methods to Counts of Phytoplankton, W76-05622 5A
Effect of Municipal Treatment Processes on	W76-05865 5D	W76-05622 5A
PU-239, PU-240, and CS-137,		ESTUARIES
W76-05890 5F	EROSION	Effects of Salinity on Nitrification in the East
W76-05890 5F	EROSION Reservoir Sedimentation Associated with	Effects of Salinity on Nitrification in the East River.
W76-05890 5F Contamination of Freshwater by Mn54 and		River,
W76-05890 5F Contamination of Freshwater by Mn54 and Co60,	Reservoir Sedimentation Associated with	
W76-05890 5F Contamination of Freshwater by Mn54 and	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential,	River,
W76-05890 5F Contamination of Freshwater by Mn54 and Co60,	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617	River, W76-05631 5C
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour,	River, W76-05631 5C Acute Toxicity of a Native Mummichog Popu-
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617	River, W76-05631 5C Acute Toxicity of a Native Mummichog Popu- lation (Fundulus Heteroclitus) to Mercury, W76-05742 5C
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit.	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972,
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-03617 4D A Stable Numerical Model for Local Scour, W76-03666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada,	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting,	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-03617 4D A Stable Numerical Model for Local Scour, W76-03666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada,	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary,
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act.	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager,	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary,
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL	River, W76-05631 Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water.	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine En-
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation Research,	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine Bivalves,
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source CategoryEffluent Guidelines and Standards.	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation Research, W76-05690 2J	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine Bivalves, W76-06134 2L
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source Category-Effluent Guidelines and Standards. W76-06085 5G	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation Research, W76-05690 2J The Forest Ecosystem of Southeast Alaska 5.	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine Bivalves, W76-06134 2L EURASIAN (WATER-MILFOIL)
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source CategoryEffluent Guidelines and Standards. W76-06085 5G ENVIRONMENTAL HEARING BOARD	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation Research, W76-05690 2J The Forest Ecosystem of Southeast Alaska 5. Soil Mass Movement,	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine Bivalves, W76-06134 2L EURASIAN (WATER-MILFOIL) Eurasian Water-Milfoil in Michigan,
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source CategoryEffluent Guidelines and Standards. W76-06085 5G ENVIRONMENTAL HEARING BOARD Commonwealth, Department of Natural	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation Research, W76-05690 2J The Forest Ecosystem of Southeast Alaska 5.	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine Bivalves, W76-06134 2L EURASIAN (WATER-MILFOIL)
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source Category-Effluent Guidelines and Standards. W76-06085 5G ENVIRONMENTAL HEARING BOARD Commonwealth, Department of Natural Resources V. Westmoreland-Fayette Municipal	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation Research, W76-05690 2J The Forest Ecosystem of Southeast Alaska 5. Soil Mass Movement,	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine Bivalves, W76-06134 2L EURASIAN (WATER-MILFOIL) Eurasian Water-Milfoil in Michigan, W76-06149 5G
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source CategoryEffluent Guidelines and Standards. W76-06085 5G ENVIRONMENTAL HEARING BOARD Commonwealth, Department of Natural Resources V. Westmoreland-Fayette Municipal Sewage Authority (Appeal by Municipal Entity	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 21 Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation Research, W76-05690 2J The Forest Ecosystem of Southeast Alaska 5. Soil Mass Movement, W76-05950 4D ESTIMATED COSTS	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine Bivalves, W76-06134 2L EURASIAN (WATER-MILFOIL) Eurasian Water-Milfoil in Michigan, W76-06149 5G EUTROPHICATION
W76-05890 5F Contamination of Freshwater by Mn54 and Co60, W76-05903 5C Northern Great Plains Resource Program. W76-06050 6D Congress Orders Moritorium on Garrison Diversion Unit. W76-06054 6E Reforming Procedures for Industrial Siting, W76-06058 6E South Dakota Environmental Policy Act. W76-06075 5G Designation and Determination of Removability of Hazardous Substances from Water. W76-06084 5G Timber Products Processing Point Source Category-Effluent Guidelines and Standards. W76-06085 5G ENVIRONMENTAL HEARING BOARD Commonwealth, Department of Natural Resources V. Westmoreland-Fayette Municipal	Reservoir Sedimentation Associated with Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics, W76-05617 4D A Stable Numerical Model for Local Scour, W76-05666 2J Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada, W76-05912 2G Interpreting Stability Problems for the Land Manager, W76-05947 4D EROSION CONTROL Underwater Wall Structure, W76-05523 8A Fallout CS-137: A Tool in Conservation Research, W76-05690 2J The Forest Ecosystem of Southeast Alaska 5. Soil Mass Movement, W76-05950 4D	River, W76-05631 5C Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury, W76-05742 5C Mirex Residues in Selected Estuaries of South Carolina: June 1972, W76-05954 5A Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C ESTUARINE ENVIRONMENT Molybdenum in a Nearshore and Estuarine Environment, North Wales. W76-06000 2K Notes on the Biology of Some Estuarine Bivalves, W76-06134 2L EURASIAN (WATER-MILFOIL) Eurasian Water-Milfoil in Michigan, W76-06149 5G

EUTROPHICATION

Eutrophication of an Inland Lake in Ireland in Association with the Intensification of Pig Farming in the Catchment Areas,	EVAPORIMETERS Ratio Between Evapotranspiration from Lysimeters and Evaporation from Small	FEASIBILITY STUDIES Vertical Electrical Resistivity Soundings to Locate Ground Water Resources: A Feasibility
W76-05629 5C	Evaporimeters Using 2- and 3- hour Periods of	Study,
Phosphorus, Nitrogen, and the Growth of	Measurement, W76-06029 2D	W76-05835 4B
Algae in Lake Kinneret,	W 70-00029	FEASIBILITY STUDY
W76-05633 5C	EVAPOTRANSPIRATION	Groundwater Study of a Volcanic Area Near
Macrovegetation and Ecological Factors in	The Hydrologic Potential of Unit Areas: A	Bandung, Java, Indonesia, W76-05914 4B
Two Norwegian Lakes,	Basis for Managing Water Resources, W76-05620 4D	W 70-03914 4B
W76-06044 5C	W76-05620 4D	FECAL PELLETS (COPEDODS)
PVALUATION	Relation of the Consumptive Use Coefficient to	Role of Copepod Fecal Pellets in the Vertical
EVALUATION Ex-Post Evaluation of River Basin Develop-	the Description of Vegetation,	Transport of Freshwater Diatoms, W76-05880 5C
ments in Pakistan,	W76-05843 2D	W 76-03880
W76-05748 6A	The Annual Variation in Yield of Pastures in	FECUNDITY
The Columbia Basin Project Beautrained	the Seasonally Dry Tropics of Queensland,	Fecundity of the Brown Bullhead, Ictalurus
The Columbia Basin Project Reappraised, W76-05750 4A	W76-06016 · 3F	Nebulosus (Le Sueur) in a Mine Acid Polluted River.
1170 03730	Datie Datumen Proposition from	W76-05641 8I
Evaluation of the Effects of Water Transfer,	Ratio Between Evapotranspiration from Lysimeters and Evaporation from Small	
W76-05751 6A	Evaporimeters Using 2- and 3- hour Periods of	FEDERAL JURISDICTION
Monetary Values of Life and Health.	Measurement,	Navigable Waters Procedures and Guidelines for Disposal of Dredged or Fill Material.
W76-05812 6F	W76-06029 2D	W76-06097 5G
	EVBEDIMENTAL LAVEC : BEA (ONTABIO)	
Detailed Economic Models for Industrial and	EXPERIMENTAL LAKES AREA (ONTARIO) Chemically Enhanced C02 Gas Exchange in a	United States V. Lewis (Action to Enjoin Con-
Other Activities, W76-05817 5G	Eutrophic Lake: A General Model.	struction of a Causeway across a Tidal Marsh
W/0-0301/	W76-05635 5C	without Permit Required Under the Rivers and Harbors Act).
An Assessment of Automatic Sewer Flow Sam-		W76-06108 6E
plers - 1975,	EXPERIMENTAL WELL FIELD	
W76-05864 5D	Experimental Well Field is Put to Many Uses,	FEDERAL-STATE WATER RIGHTS
Social Assessment Manual: A Guide to the	W76-05569 8G	CONFLICTS
Preparation of the Social Well Being Account,	EXTREME RAINFALL EVENTS	Coastal Zone Management and Intergovern- mental Coordination,
W76-05993 6B	Continuous Seasonal Probability of Extreme	W76-06057 6E
EVANGELINE AQUIFER (LA)	Rainfall Events,	
Geohydrology of the Evangeline and Jasper	W76-05692 2B	United States V. Florida (Proceeding Seeking
Aquifers of Southwestern Louisiana,	FAILURE (MECHANICS)	Definition of Seaward Boundary of Submerged Lands of Continental Shelf).
W76-05861 2F	Simple Procedures Can Help Reduce Drill Pipe	W76-06109 6E
EVAPORATION	Damage,	
Sublimation or Melting: Observations from the	W76-05572 8C	FEDERAL WATER POLLUTION CONTROL
White Mountains, California and Nevada,	FALLEN LEAF LAKE (CALIF)	ACT Structuring Communications Programs for
U.S.A.,	Selected Water-Quality Data from Fallen Leaf	Public Participation in Water Resources
W76-05683 2C	Lake, El Dorado County, California, June	Planning,
Purification of Gum Rosin Producing Plant Ef-	through October 1974,	W76-05652 6B
fluents from Resinous Substances (Ochistka	W76-05848 7C	Corps Issues Interim Rules for Discharges of
stochnykh vod kanifol'noterpentinnogo proiz-	FALLOUT	Dredged and Fill Materials.
vodstva ot smolistykh veshchestv),	Fallout CS-137: A Tool in Conservation	W76-06061 5G
W76-05735 . 5D	Research,	Environmental Drataction Assess Poultry
Desalination Apparatus,	W76-05690 2J	Environmental Protection AgencyPoultry Processing Products, Proposed Performance
W76-05959 3A	FARM PONDS	and Pretreatment Standards.
	Sediment Characteristics of Five Streams Near	W76-06096 5G
Ratio Between Evapotranspiration from Lysimeters and Evaporation from Small	Harrisburg, Pennsylvania, Before Highway	Water Quality Standards: Oregon (Withdrawa!
Evaporimeters Using 2- and 3- hour Periods of	Construction,	of Proposed Rule Making).
Measurement,	W76-05854 4C	W76-06098 5G
W76-06029 2D	FARM WASTES	
Effect of Depth and Salinity of Ground Water	Eutrophication of an Inland Lake in Ireland in	Stream Pollution Control Board of State of In-
on Evaporation and Soil Salinization,	Association with the Intensification of Pig	diana V. United States Steel Corp. (Common- Law Public Nuisance Action Against Steel
W76-06036 2D	Farming in the Catchment Areas,	Corp. in which Private Citizen Sought to Inter-
P	W76-05629 5C	vene.
Evaporation Characteristics of Three Fine-Tex- tured Tarai Soils Under Various Evaporation	Confined Animal Feeding or Holding Opera-	W76-06106 6E
Potentials,	tions.	Reserve Mining Co. V. Environmental Protec-
W76-06037 2D	W76-06072 5G	tion Agency (Action by U. S. and Minnesota to
	Nebraska Livestock Waste Cantral Parent	Prevent Discharge of Taconite Tailings into
The Microenvironment of Climacium Americanum,	Nebraska Livestock Waste Control Regula- tions.	Water of Lake Superior by Processing Com-
W76-06045 2G	W76-06079 5G	pany). W76-06107 6E
EVAPORATORS Operation of Pilot Plant LTV Evaporator at	FATIGUE (MECHANICS)	FEDERAL WATER POLLUTION CONTROL
Operation of Pilot Plant LTV Evaporator at Wrightsville Beach, North Carolina.	Simple Procedures Can Help Reduce Drill Pipe Damage,	ACT AMENDMENTS OF 1972 Stream Pollution Control Board of State of In-
W76-06049 3A	W76-05572 8C	diana V. United States Steel Corp. (Common-

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Law Public Nuisance Action Against Steel	FINITE-DIFFERENCE TECHNIQUES	FISH PARASITES
Corp. in which Private Citizen Sought to Inter-	Coupled Saturated-Unsaturated Transient Flow	Parasites of Freshwater Fishes. A Review of
vene.	in Porous Media: Experimental and Numeric	their Control and Treatment,
W76-06106 6E	Model,	W76-05953 2H
FERTILIZATION	W76-05684 2F	
Effects of Forest Fertilization on Two	FINITE ELEMENT ANALYSIS	On Diplostomosis of the Grasscarp Fry,
Southeast Alaska Streams,	Finite Element Mesh Gradation for Surface	W76-06025 2H
W76-05612 5C	Waves,	FISH REPRODUCTION
	W76-05919 8E	Biology and Bioenergetics of Grass Carp
Effects of Forest Fertilization with Urea on	W.0-03717	(Ctenopharyngodon Idella Val.),
Stream Water QualityQuilcene Ranger Dis-	FINLAND	W76-06013 21
trict, Washington,	Position of a Calcium Bisulfite Pulp Mill Par-	
W76-05938 5B	ticularly with Respect to Intensified Environ-	FISHING
Impact of Forest Fertilization on Water Quality	mental Protection Requirements (Die Position	Marine Conservation Act, Amendments.
in the Douglas-Fir Region A Summary of	einer Kalziumbisulfitfabrik, besonders im Hin-	W76-06091 6E
Monitoring Studies,	blick auf verschaerfte Umweltschutzforderun-	PIONETT
W76-05943 5B	gen),	FISHKILL
	W76-05722 5G	Effect of Bleached Kraft Mill Effluent on the
FERTILIZERS	NIST.	Survival of Starved Juvenile Coho Salmon
Control of Nitrogen Transformations in Soils,	FISH	(Oncorhynchus Kisutch), W76-05710 5C
W76-05608 5B	An Ichthyofaunal Survey and Discussion of	W 76-03710 3C
The Impact of Timber Harvest, Fertilization,	Fish Species Diversity as an Indicator of Water	FLOATING
and Herbicide Treatment on Streamwater	Quality, Codorus Creek Drainage, York Coun-	Apparatus for Collecting Surface Particle on
Quality in Western Oregon and Washington,	ty, Pennsylvania,	Body of Water,
W76-05618 5B	W76-05634 5A	W76-05970 5G
35	Fecundity of the Brown Bullhead, Ictalurus	
Behaviour of Some Phosphatic Fertilizers in	Nebulosus (Le Sueur) in a Mine Acid Polluted	FLOCCULATION
Water,	River,	Flocculation Apparatus,
W76-06139 5B	W76-05641 8I	W76-05989 5F
FILTERS	Accumulation and Elimination of Dieldrin by	FLOOD CONTROL
Cross-Flow Filtration and Axial Filtration,	Channel Catfish (Ictalurus Punctatus),	Flood Loss Management in Developing Coun-
W76-05788 5D	W76-05642 5C	tries: A Model for Identifying Appropriate
Design and Operation of High-Rate Filters	1	Strategies,
Part 2,	Fisheries Research,	W76-05761 6A
W76-05831 5D	W76-05878 5C	n 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1
W70-03031		Evaluation of Economic Benefits for Flood
Design and Operation of High-Rate Filters	Characteristics of Temperature-Sensitive Fish	Control and Water Resource Planning.
Part 3,	Tags Used in 1974,	W76-06083 4A
W76-05832 * 5F	W76-05897 5C	FLOOD DAMAGE
	Body Temperature Change Characteristics of	Flood Plain Information: Little McMullen
Filter Cleaning Method,	Lake Michigan Fishes,	Creek, Jesup, Georgia.
W76-05974 5F	W76-05899 5C	W76-05648 4A
PH TRATION	W 70-03633	W 70-03046
FILTRATION	Body Temperatures of Fish Feeding in The	Benefit and Cost Analysis of Hydrological
Liquid Purifying Process, W76-05528 5D	Point Beach Thermal Discharge,	Forecasts.
W 76-03328 3D	W76-05900 5C	W76-05823 6B
Filtering Apparatus and Process,		
W76-05546 5D	Obstruction of Streams or Lakes by Fyke Nets	Lanning V. State Highway Commission (Flood
	or Other Devices.	Damage by Debris Collected in Front of Bridge
Cross-Flow Filtration and Axial Filtration,	W76-06089 6E	Piers).
W76-05788 5D		W76-06113 6E
Oller a law a limbar a au	Distribution of Fish in Inland Saline Waters in	
Old Slow Sand + New Rapid Filtration - Sedi-	Victoria, Australia,	FLOOD DATA
mentation = Savings,	W76-06143 2H	The 1973 Mississippi River Basin Flood: Com-
W76-05808 5F	FISH BARRIERS	pilation and Analyses of Meteorologic, Stream-
Design and Operation of High-Rate Filters	Obstruction of Streams or Lakes by Fyke Nets	flow, and Sediment Data,
Part 2,	or Other Devices.	W76-05860 2E
W76-05831 5D	W76-06089 6E	FLOOD FORECASTING
	W 70-00087	Flood Routing in Channel Systems with Al-
Design and Operation of High-Rate Filters	FISH BEHAVIOR	lowance for Bank Regulation,
Part 3,	Acute Toxicity of a Native Mummichog Popu-	W76-05668 4A
W76-05832 5F	lation (Fundulus Heteroclitus) to Mercury,	1770 00000
File-Classic Marks	W76-05742 5C	Benefit and Cost Analysis of Hydrological
Filter Cleaning Method,		Forecasts,
W76-05974 5F	FISH DIETS	W76-05823 6B
FINANCING	Food Habits of the Rough Shiner, Notropis	
Financing the New Water Authorities,	Baileyi Suttkus and Raney, in Halawakee	FLOOD FREQUENCY
W76-05810 6C	Creek, Alabama,	The Hydrologic Potential of Unit Areas: A
	W76-06126 2I	Basis for Managing Water Resources,
State Water Quality Control Fund.	NIGHT BOOD ORGANISMS	W76-05620 4D
W76-06063 5G	FISH FOOD ORGANISMS	Carriel Plant Hand Information D
0	Food Habits of the Rough Shiner, Notropis	Special Flood Hazard Information Report:
State Financial Assistance to Public Agencies	Baileyi Suttkus and Raney, in Halawakee	Howell Creek Basin Lakes, Orange County,
for Pollution Control Facilities. W76-06073	Creek, Alabama, W76-06126	Florida, W76-05646 4A

FLOOD LOSS

Flood Loss Flood Loss Management in Developing Countries: A Model for Identifying Appropriate Strategies,	Creek, Jesup, Georgia. W76-05648 4A	pilation and Analyses of Meteorologic, Stream- flow, and Sediment Data, W76-05860 2E
W76-05761 6A	FLOOD PROOFING	FLOODWAYS
FLOOD PLAIN INSURANCE Coping with Flood Hazard in New Braunfels and Seguin, Texas,	Suggested Provisions to Be Used in Zoning Or- dinances for Compliance with Sections 1910.3(C) of the National Flood Insurance Pro- gram.	Flood Hazard Analyses: Buffalo River, Amherst County, Virginia. W76-05643 4A
W76-05502 6F	W76-06060 6F	Flood Hazard Analyses: Blacks Run-Cooks
FLOOD PLAIN ZONING Flood Hazard Analyses: Buffalo River, Amherst County, Virginia.	FLOOD PROTECTION Coping with Flood Hazard in New Braunfels and Seguin, Texas,	Creek, Rockingham County and Harrisonburg, Virginia. W76-05644 4A
W76-05643 4A	W76-05502 6F	FLORIDA
Flood Hazard Analyses: Blacks Run-Cooks Creek, Rockingham County and Harrisonburg,	Flood Hazard Analyses: Buffalo River, Amherst County, Virginia.	Special Flood Hazard Information Report: Howell Creek Basin Lakes, Orange County, Florida,
Virginia. W76-05644 4A	W76-05643 4A	W76-05646 4A
	Flood Hazard Analyses: Blacks Run-Cooks	Flood Plain Information: Coastal Areas, Levy
Certain Land Use Regulations to Protect from Danger of Flooding.	Creek, Rockingham County and Harrisonburg, Virginia.	County, Florida. W76-05647 4A
W76-06059 6F	W76-05644 4A	
Suggested Provisions to Be Used in Zoning Or- dinances for Compliance with Sections	Criteria for Evaluation of Social Impacts of Flood Management Alternatives,	Perspective 75. W76-05651 6B
1910.3(C) of the National Flood Insurance Program.	W76-05653 6B	Effective Use of High Water Table Areas for Sanitary Landfill. Vol. II,
W76-06060 6F	Certain Land Use Regulations to Protect from Danger of Flooding.	W76-05744 5G
FLOOD PLAINS Flood Hazard Analyses: Buffalo River, Am-	W76-06059 6F	Relation of Water Level and Fish Availability
herst County, Virginia.	FLOOD ROUTING	to Wood Stork Reproduction in the Southern Everglades, Florida,
W76-05643 4A	Flood Routing in Channel Systems with Al-	W76-05850 21
Flood Hazard Analyses: Blacks Run-Cooks Creek, Rockingham County and Harrisonburg,	lowance for Bank Regulation, W76-05668 4A	Floridan Aquifer in Northeast FloridaThree MapsHardness of Water, Chloride Concentra-
Virginia. W76-05644 4A	FLOOD STAGES Special Flood Hazard Information Report:	tion, and Potentiometric Surface, May 1974, W76-05859 70
Flood Plain Information: Illinois and Michigan Canal, Rock Run Creek, Thorne Creek, Joliet,	Howell Creek Basin Lakes, Orange County, Florida, W76-05646 4A	United States V. Florida (Proceeding Seeking Definition of Seaward Boundary of Submerged
Illinois. W76-05645 4A	FLOODING	Lands of Continental Shelf). W76-06109 6E
Special Flood Hazard Information Report: Howell Creek Basin Lakes, Orange County,	Wilber V. Western Properties (Whether an Artificially Altered Watercourse is a Natural or	Differential Responses to Drought in Two Species of Fundulus,
Florida, W76-05646 4A	Artificial Channel a Matter of Law). W76-06103 6E	W76-06132 2H
Flood Plain Information: Coastal Areas, Levy	FLOODPROOFING	FLORIDA BAY United States V. Florida (Proceeding Seeking
County, Florida. W76-05647 4A	Flood Hazard Analyses: Blacks Run-Cooks Creek, Rockingham County and Harrisonburg,	Definition of Seaward Boundary of Submerged Lands of Continental Shelf).
Flood Plain Information: Little McMullen	Virginia. W76-05644 4A	W76-06109 6E
Creek, Jesup, Georgia.	FLOODS	FLOTATION Escher-Wyss Flotation Cells for Clarification
W76-05648 4A FLOOD PROFILES	Flood Plain Information: Illinois and Michigan Canal, Rock Run Creek, Thorne Creek, Joliet,	and Cleaning (Die Escher-Wyss Flotationszel- len zur Klaerung und Reinigung),
Flood Hazard Analyses: Buffalo River, Am-	Illinois.	W76-05723 5D
herst County, Virginia. W76-05643 4A		Flotation Process and Apparatus. W76-05767 5D
Flood Hazard Analyses: Blacks Run-Cooks	Special Flood Hazard Information Report: Howell Creek Basin Lakes, Orange County,	Dissolved Air Floatation System,
Creek, Rockingham County and Harrisonburg, Virginia.	Florida, W76-05646 4A	W76-05976 5E
W76-05644 4A		FLOTATION THICKENERS
Flood Plain Information: Illinois and Michigan Canal, Rock Run Creek, Thorne Creek, Joliet,	Flood Plain Information: Coastal Areas, Levy County, Florida. W76-05647 4A	Engineers Can Exert Process Control Over Digester Inputs, W76-05807 5E
Illinois. W76-05645 4A	Flood Plain Information: Little McMullen	FLOW
Special Flood Hazard Information Report: Howell Creek Basin Lakes, Orange County,	Crcek, Jesup, Georgia. W76-05648 4A	Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulen
Florida,	Perspective 75. W76-05651 6B	Flows, W76-05924 8E
		FLOW CHARACTERISTICS
Flood Plain Information: Coastal Areas, Levy County, Florida. W76-05647 4A	Criteria for Evaluation of Social Impacts of Flood Management Alternatives, W76-05653 6B	Flood Plain Information: Little McMuller Creek, Jesup, Georgia.
47	обобо	W76-05648 4/

FLOW MEASUREMENT	(Abwasserabgabengesetz-Belastungen und Fol-	FRUIT CROPS
Flowmeter for an Open Aqueduct, W76-05540 7B	gerungen fuer die Papierindustrie), W76-05712 5G	Ionic Leaf Accumulation in Grapes, Guava and
W 70-03340 7B	W76-05712 5G	Olive Plants as Affected by the Salinity of Ir-
Sewer Flow Measurement - A State-Of-The-Art	Status of Water Pollution Control in the Soviet	rigation Water, W76-06030 3C
Assessment,	Union,	W 70-00030
W76-05865 5D	W76-05714 5G	FRUSTULES
FLOW RESISTANCE		Distribution of Amorphous, Diatom Frustule,
Equations for Resistance to Flow and Sediment	FOREST LITTER	and Dissolved Silica in a Lead-210 Dated Core
Transport in Alluvial Channels,	Some Relations Between Forest Litter and	from Southern Lake Michigan,
W76-05844 2J	Growth of Sitka Spruce on Poorly Drained	W76-05883 5C
	Soils, W76-05687 21	PENCE
FLOW VELOCITY	W 70-03087	FUNGI
Nomograms for Simplified Hydraulic Dimen-	FOREST MANAGEMENT	Microbiological and Chemical Enrichment of Freshwater-Surface Microlayers Relative to the
sioning of Waste Water Ducts (Nomogramme Zur Vereinfachten Hydraulischen Bemessung	Guidelines for Characterizing Naturally Unsta-	Bulk-Subsurface Water,
Von Abwasser-Kanaelen),	ble or Potentially Unstable Slopes on Western	W76-06124 5C
W76-05610 5D	National Forests,	30
	W76-05621 4D	FURROW IRRIGATION
FLOWMETERS	Coolers and Commentation of the III I Am	Grapevine Response to Furrow and Trickle Ir-
Flowmeter for an Open Aqueduct,	Geology and Geomorphology of the H. J. An-	rigation,
W76-05540 7B	drews Experimental Forest, Western Cascades, Oregon,	W76-06032 3F
Sewer Flow Measurement - A State-Of-The-Art	W76-05941 4D	
Assessment,	40	FUTURE PLANNING (PROJECTED)
W76-05865 5D	Impact of Forest Fertilization on Water Quality	The Master Plan for Water Supply in the Re-
	in the Douglas-Fir Region A Summary of	gional Municipality of Ottawa-Carleton,
FLUID DRILLING	Monitoring Studies,	W76-05815 6D
Air Rotary Drilling with Organic Polymers Of-	W76-05943 5B	FWPCA AMENDMENTS OF 1972
fers Many Benefits,		Corps Issues Interim Rules for Discharges of
W76-05562 8B	FOREST SOILS	Dredged and Fill Materials.
FLUMES	Effect of Cacodylic Acid and MSMA on	W76-06061 5G
Discharge Equations for HS, H, and HL	Microbes in Forest Floor and Soil,	W/0 00001
Flumes,	W76-05940 5C	GAMMA RAYS
W76-05918 8B	FORESTS	An Evaluation of the Use of Gamma Radiation
THE PROPERTY WITH THE PARTY OF	Slope Runoff and Its Change Under the Effect	in Sewage Treatment,
FLUORESCENT WHITENING AGENTS (FWA)	of Agricultural and Forest Improvement Prac-	W76-05803 5D
Removal of Detergent Fluorescent Whitening Agents from Waste Water,	tices.	
W76-05804 5D	W76-05927 4C	GAMMARUS-ZADDACHI
W 70-05004		Further Observations on the Migration of Gam-
FLY ASH	FORMATION STABILIZED WELLS	marus Zaddachisexton (Crustacea, Amphipoda)
Lab-Proven Fly Ash Process Removes Bleach	Use of Formation Stabilizer - A Valuable	in a French Stream,
Effluent Color,	Technique,	W76-06046 21
W76-05707 5D	W76-05564 8A	GARRISON DIVERSION PROJECT
Process for the Treatment of Mineral Slimes,	FRANCE	The International Law Aspects of the Garrison
W76-05973 5D	Further Observations on the Migration of Gam-	Diversion Project,
	marus Zaddachisexton (Crustacea, Amphipoda)	W76-06053 6E
FONTINALIS-SQUAMOSA	in a French Stream,	
Notes on the Production of Stream Bryophytes	W76-06046 21	Congress Orders Moritorium on Garrison
in the High Pyrenees (France),		Diversion Unit.
W76-06129 21	FRANCE (BREST REGION)	W76-06054 6E
FOOD CHAIN	Evaluation of Surface Water Pollution at	
Plutonium in Aquatic Biota of the Great Miami	Several Points in Relation to Zones of Shellfish	GAS CHROMATOGRAPHY
River Watershed, Ohio,	Industry in Roadsteads of the Brest Region, (In	Chemical Characterization of Industrial Waste-
W76-05888 5C	French),	waters by Gas Chromatography-Mass Spec-
Book on the	W76-06150 5B	trometry, W76-06008 5A
FOOD CHAINS	FRANCE (PYRENEES REGION)	W76-06008 5A
Effect of Environmental Factors on Standing Crop of Plankton in British Columbia Lakes,	Notes on the Production of Stream Bryophytes	GASES
W76-05741 5C	in the High Pyrenees (France),	Table of Data on Water Quality of Baker Lake
170-03/41	W76-06129 21	near Mount Baker, Washington,
FOOD PROCESSING INDUSTRY		W76-05857 7C
Combined Waste Treatment Proves Economi-	FRAZIL ICE	
cal and Feasible,	Nucleation Characteristics of Stream Water	GEOCHRONOLOGY
W76-05787 5D	and Frazil Ice Nucleation,	Stable Lead Geochronology of Fine-Grained
FORECASTING	W76-05695 2C	Sediments in Southern Lake Michigan,
Forecasting Water Levels in Aquifers by Nu-	FREE PASSAGEWAY (FISH)	W76-05884 5B
merical and Semihybrid Methods,	Obstruction of Streams or Lakes by Fyke Nets	Geochronology of Lake Michigan Sediments:
W76-05686 2F	or Other Devices.	Anomalies in Lead-210 Distributions.
Madella de Rifera d' War Birt	W76-06089 6E	W76-05885 5B
Modeling the Effect of Waste Discharges in a	0E	
Small Mountain Stream, W76-05834 5B	FREE SURFACES	GEOHYDROLOGIC UNITS
11 /U-UJ0J4 3B	Coupled Saturated-Unsaturated Transient Flow	Geology and Water Resources of Charles Mix
FOREIGN COUNTRIES	in Porous Media: Experimental and Numeric	and Douglas Counties, South Dakota, Part I:
Effluent Discharge Law-Burdens and Con-	Model,	Geology,
sequences for the Paper Industry	W76-05684 2F	W76-05923 4A

G

G

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GU S T I

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GEOLOGIC FORMATIONS

GEOLOGIC FORMATIONS	GEYSERS	GROUNDWATER
Geology and Water Resources of Charles Mix and Douglas Counties, South Dakota, Part I:	How Steam Is Produced and Handled at the Geysers,	Optimal Groundwater Quality Management: Well Injection of Waste Waters,
Geology, W76-05923 4A	W76-05574 8C	W76-05507 5B
W 70-03923	GILA RIVER FLOOD PLAIN (ARIZ)	Protecting Groundwater from Landfill
GEOLOGIC HISTORY Collapse of the Hudson Bay Ice Center and	Relation of the Consumptive Use Coefficient to the Description of Vegetation.	Leachate, W76-05599 5G
Glacio-Isostatic Rebound, W76-05669 2C	W76-05843 2D	Classification of Methods of Groundwater
11 70-03007	GLACIERS	Management (Klassificaksiiya metodov
GEOLOGIC INVESTIGATIONS Geology and Water Resources of Charles Mix	Equilibrium-Line Altitudes, Mass Balance, and July Freezing-Level Heights in the Canadian	upravleniya rezhimom i resursami podzemnykh vod),
and Douglas Counties, South Dakota, Part I:	High Arctic,	W76-05600 4B
Geology, W76-05923 4A	W76-05682 2C	Effective Use of High Water Table Areas for
GEOLOGIC MAPPING	Some Observations on the Behavior of the	Sanitary Landfill. Vol. II,
Geohydrology of the Evangeline and Jasper Aquifers of Southwestern Louisiana,	Liquid and Gas Phases in Temperate Glacier Ice,	W76-05744 5G
W76-05861 2F	W76-05915 2C	Reverse Osmosis Plant Helps City Cope with Diminishing Groundwater Supply,
Geology and Water Resources of Charles Mix	The Thermal Regime of Trapridge Glacier and Its Relevance to Glacier Surging,	W76-05779 5F
and Douglas Counties, South Dakota, Part I: Geology,	W76-05916 2C	Nitrate Removal from Water by Ion Exchange,
W76-05923 4A	GOVERNMENT FINANCE	W76-05806 5F
GEOMORPHOLOGY	State Financial Assistance to Public Agencies	Vertical Electrical Resistivity Soundings to
Guidelines for Characterizing Naturally Unsta-	for Pollution Control Facilities.	Locate Ground Water Resources: A Feasibility
ble or Potentially Unstable Slopes on Western	W76-06073 5G	Study, W76-05835 4B
National Forests, W76-05621 4D	GOVERNMENTAL INTERRELATIONS	
	Coastal Zone Management and Intergovern-	Floridan Aquifer in Northeast FloridaThree
Hydraulic Computation of a Pool Hollow, W76-05931 2E	mental Coordination,	MapsHardness of Water, Chloride Concentra- tion, and Potentiometric Surface, May 1974,
	W76-06057 6E	W76-05859 7C
Geology and Geomorphology of the H. J. An-	GRADATION	Purpoine Test Analysis Using a Discrete Time
drews Experimental Forest, Western Cascades, Oregon,	Eutrophic Gradient in Smith Mountain Lake,	Pumping-Test Analysis Using a Discrete Time- Discrete Space Numerical Method,
W76-05941 4D	Virginia, W76-05627 5C	W76-05913 4B
GEOPRESSURE	11.10 03027	Bartley V. Sone (Right of Individual to the Use
ERDA's Tiger Lagoon Program to Probe New	GRAIN SORGHUM	of Spring Waters Located Wholly on His Land
Energy Source.	Water Movement Within the Root Zone of Ir- rigated and Nonirrigated Grain Sorghum,	for Any Purpose).
W76-05568 8A	W76-05994 2G	W76-06099 6E
GEORGIA		GROUNDWATER AVAILABILITY
Flood Plain Information: Little McMullen	GRAPEVINE GROWTH Grapevine Response to Furrow and Trickle Ir-	Judging the Availability of Ground Water.
Creek, Jesup, Georgia. W76-05648 4A	rigation,	W76-05558 4B
	W76-06032 3F	Ground Water is the Only Real Reserve this
United States V. Lewis (Action to Enjoin Con-	CRASS CARR	Country Has.
struction of a Causeway across a Tidal Marsh without Permit Required Under the Rivers and	GRASS CARP Biology and Bioenergetics of Grass Carp	W76-05567 4B
Harbors Act).	(Ctenopharyngodon Idella Val.),	Groundwater Study of a Volcanic Area Near
W76-06108 6E	W76-06013 2I	Bandung, Java, Indonesia,
GEOTECHNICAL ENGINEERING	GRAVEL PACK DESIGN	W76-05914 4B
INSTRUMENTATION	Proper Selection of Gravel Pack is Key to Suc-	GROUNDWATER LEVELS
Seismic Instrumentation of Dams,	cessful Wells,	Development and Field Testing of a Basin
W76-05667 8D	W76-05565 8C	Hydrology Simulator,
GEOTHERMAL ENERGY	GRAVELS	W76-05745 2A
ERDA's Tiger Lagoon Program to Probe New	Proper Selection of Gravel Pack is Key to Suc-	GROUNDWATER MINING
Energy Source.	cessful Wells,	History of Ground Water Development,
W76-05568 8A	W76-05565 8C	W76-05556 4B
How Steam Is Produced and Handled at the	GRAZING	Judging the Availability of Ground Water.
Geysers, W76-05574 8C	Reservoir Sedimentation Associated with	W76-05558 4B
	Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics,	GROUNDWATER MODELING
GEOTHERMAL STUDIES ERDA'S Tiger Lagoon Program to Probe New	W76-05617 4D	An Identification Approach to Subsurface
Energy Source.		Hydrological Systems,
W76-05568 8A	GREAT BEND SILT LOAM Water Movement Within the Root Zone of Ir-	W76-05688 2F
GERMANY	rigated and Nonirrigated Grain Sorghum,	GROUNDWATER MOVEMENT
Effluent Discharge Law-Burdens and Con-	W76-05994 2G	History of Ground Water Concepts,
sequences for the Paper Industry		W76-05551 2F
(Abwasscrabgabengesetz-Belastungen und Folgerungen fuer die Papierindustrie),	GREAT PLAINS Northern Great Plains Resource Program.	Movement of Tracers Through Soil,
W76-05712 5G	W76-06050 6D	W76-05701 5B

B

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GROUNDWATER RECHARGE	GULF OF ST LAWRENCE	Temperature Optimum of Algae Living in the
Ground Water is the Only Real Reserve this	Trace Metals in the Waters of the Gulf of St.	Outfall of a Power Plant on Lake Monona,
Country Has. W76-05567 4B	Lawrence, W76-06024 5A	W76-06001 5C
GROUNDWATER RESOURCES	GYPSUM	HEAVY METALS Interactions of Mercury with Aquatic and
History of Ground Water Concepts,	Salt Transport in Soil Profiles with Application	Edaphic Environments,
W76-05551 2F	to Irrigation Return Flow, The Dissolution and Transport of Gypsum in Soils,	W76-05601 5B
Judging the Availability of Ground Water. W76-05558 4B	W76-05836 5B	Silver in Photoprocessing Effluents, W76-05732 5D
C - 1 W - 1 4 C 1 P 1 P 41	HAIL	W 10-05/32
Ground Water is the Only Real Reserve this Country Has.	Isotopic Study of Hail,	Acute Toxicity of a Native Mummichog Popu-
W76-05567 4B	W76-05665 2B	lation (Fundulus Heteroclitus) to Mercury, W76-05742 5C
A Digital-Computer Model for Estimating	HANLON CREEK (ONTARIO-CANADA)	W 10-03/42
Hydrologic Changes in the Aquifer System in Dane County, Wisconsin,	Hanlon Creek Ecological Study, Phase B. W76-05650 6G	Impact of Coal Strip Mining on Water Quality and Hydrology of East Tennessee,
W76-05851 2F	HARBORS	W76-05833 5B
Evaluation of Data Availability and Examples	Port Collection and Separation Facilities for	Method of Extracting Heavy Metals from In-
of Modeling for Ground-Water Management on	Oily Wastes. Vol. 5. A Comparative Analysis of Conceptual System Plans for the Surveyed	dustrial Waste Waters,
Cape Cod, Massachusetts,	Ports Under the 'No Discharge', '1969 Amend-	W76-05966 5D
W76-05856 4B	ments' and 'No Sheen' Criteria,	HELMINTHS
Geohydrology of the Evangeline and Jasper	W76-05830 5D	Some Helminths of Bulinus Truncatus and
Aquifers of Southwestern Louisiana,	HARDNESS (WATER)	Biomphalaria Alexandrina from the Irrigation
W76-05861 2F	Inhibition of Scale Deposition,	System Near Cairo,
Annilability of Court Wester in the Andrews	W76-05529 5D	W76-06028 5A
Availability of Ground Water in the Androscog- gin River Basin, Northern New Hampshire,	11.10 03325	WERRIGIES BEGINSTE
W76-05862 7C	Removal of Copper and Iron Prior to Water Hardness Titration,	HERBICIDE RESIDUES Dicamba Residues in Streams After Forest
Groundwater Study of a Volcanic Area Near	W76-05716 5A	Spraying,
Bandung, Java, Indonesia,		W76-05949 5B
W76-05914 4B	Floridan Aquifer in Northeast FloridaThree MapsHardness of Water, Chloride Concentra-	HERBICIDES
GROUNDWATER TEMPERATURE	tion, and Potentiometric Surface, May 1974,	The Impact of Timber Harvest, Fertilization,
Yukon City's New Well Replaces Five Older	W76-05859 7C	and Herbicide Treatment on Streamwater
Ones,		Quality in Western Oregon and Washington,
W76-05566 4B	HAWAII	W76-05618 5B
	Conditional Expected Tsunami Inundation for	Pesticide Residue Dynamics in a Forest
GROWTH RATES	Hawaii, W76-05920 8B	Ecosystem: A Compartment Model,
Growth of Plume Resident Fishes in Lake	W 70-03920 8B	W76-05946 5B
Michigan, W76-05901 5C	The Indigenous Trees of the Hawaiian Islands,	
11 /0-03/01	W76-06005 21	HIGH-RATE FILTERS
Notes on the Biology of Some Estuarine	A Non-Administration Transferred to the	Design and Operation of High-Rate Filters
Bivalves,	A Non-Adapted Vegetation Interferes with Water Removal in a Tropical Rain Forest Area	Part 2,
W76-06134 2L	in Hawaii,	W76-05831 5D
Plant Development Under Snow,	W76-06042 4A	Design and Operation of High-Rate Filters
W76-06147 21		Part 3,
-	HAZARDOUS SUBSTANCES	W76-05832 5F
GROWTH STAGES	Designation and Determination of Removability	
Biology and Bioenergetics of Grass Carp	of Hazardous Substances from Water. W76-06084 5G	HIGH VOLTAGE PULSES
(Ctenopharyngodon Idella Val.),	W76-06084 5G	Detachment of Pendant Water Drops by High
W76-06013 2I	HAZARDS	Voltage Pulses,
Plant Development Under Snow,	Comparative Risk-Cost-Benefit Study of Alter-	W76-05917 2B
W76-06147 2I	native Sources of Electrical Energy,	HIGH YIELD WELLS
	W76-05829 6B	Siphon System Yields Chilean Plant More
GUAM	HEAT BUDGET	Water.
Submerged Lands Legislation Affecting Guam,	Surface Energy Budget of Some Climatic	W76-05550 8C
The Virgin Islands, and American Samoa (HR 11559).	Regimes in West Africa,	
W76-06080 6E	W76-06006 2B	HISSAR (INDIA)
		Climatic Water Balance at Hissar,
GULF COASTAL PLAIN	HEAT FLOW	W76-06041 2B
Pine Management Influences the Southern	How Steam Is Produced and Handled at the	HISTORY
Water Resource,	Geysers,	History of Ground Water Concepts,
W76-05616 5B	W76-05574 8C	W76-05551 2F
Harvesting Southern Forests: A Threat to	HEAT TRANSFER	41
Water Quality,	Operation of Pilot Plant LTV Evaporator at	History of Ground Water Development,
W76-05945 5B	Wrightsville Beach, North Carolina.	W76-05556 4B
	W76-06049 3A	
GULF OF MEXICO		HOLOCENE EPOCH
United States V. Florida (Proceeding Seeking	HEATED WATER	Late Pleistocene and Holocene Depositional
Definition of Seaward Boundary of Submerged Lands of Continental Shelf).	Brackish-Water Phytoplankton Response to Temperature Elevation,	Trends, Processes, and History of Astoria Deep-Sea Fan, Northeast Pacific,
W76-06109 6E	W76-05999 5C	W76-05845 2L
UL		

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HOUSATONIC RIVER

		Total Deflection to Delegan to Observe
HOUSATONIC RIVER	HYDROLOGIC ASPECTS	Internal Reflections in Polar Ice Sheets,
To Amend the Wild and Scenic Rivers Act (on	Hydrologic Aspects of Urbanization,	W76-05681 2C
S. 10 and S. 1004).	W76-05925 4C	Come Observations on the Debouier of the
W76-06081 6E		Some Observations on the Behavior of the
	HYDROLOGIC BUDGET	Liquid and Gas Phases in Temperate Glacier
HUDSON BAY (CANADA)	Relation of the Consumptive Use Coefficient to	Ice,
Collapse of the Hudson Bay Ice Center and	the Description of Vegetation,	W76-05915 2C
Glacio-Isostatic Rebound,	W76-05843 2D	ICE COVER
W76-05669 2C		Collapse of the Hudson Bay Ice Center and
	Dependable Yield of Reservoirs with Intermit-	
HUMAN DISEASES	tent Inflows,	Glacio-Isostatic Rebound,
Outbreaks of Waterborne Disease in the United	W76-05908 4A	W76-05669 2C
States, 1971-1972,	a to a to the Water to the Water	ICE NUCLEI
W76-06138 5C	Groundwater Study of a Volcanic Area Near	Field Observations of the Persistence of AgI-
	Bandung, Java, Indonesia,	NH4I-Acetone Ice Nuclei in Daylight,
HUMAN POPULATION	W76-05914 4B	W76-05677 3B
An Evaluation of Some Recreational, Demo-	Many of the Planests of the Hudselesia	W 70-03077
graphic and Economic Impacts of Canyon	Maps of the Elements of the Hydrologic	IDAHO
Lake,	Budget of Asia,	Shaub V. Fifth Judicial District (Adjudication
W76-05506 6B	W76-05934 2A	of Water Rights in Main Stream Also an Adju-
	HYDROLOGIC DATA	dication of Rights in Tributaries),
Social Impacts of Integrated River Basin		W76-06104 6E
Development on Local Populations,	A Review of Some Hydrological Studies	W /6-06104 6E
W76-05755 6A	Required in the Design of Water Management	ILLINOIS
	Projects.	Flood Plain Information: Illinois and Michigan
HUNGARY	W76-05517 4A	Canal, Rock Run Creek, Thorne Creek, Joliet,
Recent Trends in Water Quality Management		
and Protection in Hungary,	The 1973 Mississippi River Basin Flood: Com-	Illinois.
W76-05518 5G	pilation and Analyses of Meteorologic, Stream-	W76-05645 4A
W 70-03316	flow, and Sediment Data,	Flood-Caused Tree Mortality Around Illinois
Legal Framework of Co-Operation in the Field	W76-05860 2E	
of Water Management Between Hungary and		Reservoirs,
Her Neighboring Countries,	Correction of Bias in the Estimation of the	W76-06027 4A
	Coefficient of Skewness,	Illinois Designer Law The Dominant Estate
W76-05759 6E	W76-05910 2E	Illinois Drainage LawThe Dominant Estate
HURRICANES		Owner May Not Increase the Rate or Amount
	HYDROLOGIC SYSTEMS	of Surface Water Run-Off onto the Servient
Flood Hazard Analyses: Buffalo River, Am-	Development and Field Testing of a Basin	Estate Beyond a Range Consistent with a Pol-
herst County, Virginia.	Hydrology Simulator,	icy of Reasonable Use,
W76-05643 4A	W76-05745 2A	W76-06051 4A
Flood Plain Information: Coastal Areas, Levy	Evaluation of Data Availability and Examples	ILLINOIS AND MICHIGAN CANAL (IL)
County, Florida.	of Modeling for Ground-Water Management on	Flood Plain Information: Illinois and Michigan
W76-05647 4A	Cape Cod, Massachusetts,	Canal, Rock Run Creek, Thorne Creek, Joliet,
	W76-05856 4B	Illinois.
HYBRID COMPUTERS	W 70-03830 4B	W76-05645 4A
Forecasting Water Levels in Aquifers by Nu-	HYDROLOGY	
merical and Semihybrid Methods,	Nuclear Techniques in HydrologyCurrent	IMPACT SPRINKLER
W76-05686 2F	Status and Prospective Uses.	Impact Sprinkler,
	W76-05922 5A	W76-05956 3F
HYDRAULIC CONDUCTIVITY	W /6-03922 3A	
Spatial Variability of in Situ Unsaturated	HYDROLYSIS	IMPACT SPRINKLERS
Hydraulic Conductivity of Maddock Sandy	Nature and Stability of Complex Mercury	Balanced Sprinkler Impact Drive,
Loam,		W76-05957 3F
W76-05670 2G	Compounds in Surface and Ground Waters,	
11 10 03010	Phase II,	IMPOUNDMENTS
HYDRAULIC PROPERTIES	W76-05838 5A	Chemistry of Mud-Water Interface in an Im-
Aquifer Evaluation Using Depositional	WINDS HANDAN	poundment,
Systems: An Example in North-Central Texas,	HYPOLIMNION	W76-05630 5C
W76-05554 2F	Development of Oxygen Deficits in 14	
17 (U-U333)4 2F	Southern Ontario Lakes,	INCINERATION
HYDRAULIC STRUCTURES	W76-05679 5C	Incineration's Role in Ultimate Disposal of
		Process Wastes,
Siphon System Yields Chilean Plant More	ICE	W76-05791 5E
Water,	Lake and Shore Ice Conditions on Southeast-	
W76-05550 8C	ern Lake Michigan in the Vicinity of the	INCOME
HYDROGEOLOGY	Donald C. Cook Nuclear Plant: Winter 1973-74,	Costs as a Guide to Pricing,
HYDROGEOLOGY	W76-05664 2C	W76-05570 6C
Land Subsidence and Aquifer-System Compac-	STATE OF THE PARTY	
tion in the San Jacinto Valley, Riverside Coun-	Collapse of the Hudson Bay Ice Center and	An Economic Analysis of Water Use in
ty, CaliforniaA Progress Report,	Glacio-Isostatic Rebound,	Colorado's Economy,
W76-05847 2F	W76-05669 2C	W76-05837 6B
HYDROGRAPHS	The Movement of Melting Ice over Rough Sur-	INDIA
Quality and Variation of Pollutant Loads in	faces,	Trend Analysis of Annual Indian Rainfall,
Urban Stormwater Runoff,	W76-05671 2C	W76-05691 2B
W76-05576 5B		
	The Permittivity and Attenuation in	Tertiary Treatment Plant for Multistoried
QUURM - A Realistic Urban Runoff Model,	Polycrystalline and Single-Crystal Ice Ih at 30	Building,
W76-05577 2A	and 60 MHz,	W76-05789 5D
	W76-05672 2C	
Development and Field Testing of a Basin		Factors in the Purification of Flowing Sewage
Hydrology Simulator,	Brittle Fracture of Ice at 77 K,	and Activated Sludge Process, Part I,
W76-05745 2A	W76-05673 2C	W76-05795 5D

Evaporation Characteristics of Three Fine-Tex-	Method of Treating Waste Liquids from Photo-	Survival of Escherichia Coli in Stream Water in
tured Tarai Soils Under Various Evaporation	graphic Processings,	Relation to Carbon Dioxide and Plant
Potentials, W76-06037 2D	W76-05963 5D	Photosynthesis, W76-05628
	Process for Separating Oil from Emulsions of	W76-05628 50
Seasonal Variation in Dissolved Carbohydrate	Oil in Water,	Effects of Salinity on Nitrification in the East
(DCHO) Content in Three Freshwater Ponds, W76-06117 2H	W76-05964 5D	River, W76-05631
W/0-0011/	Method of Extracting Heavy Metals from In-	W76-05631
INDIA (UTTAR PRADESH)	dustrial Waste Waters,	Anaerobic Digestion: The Rate-Limiting
Application of Infrared Spectroscopy to Erodi-	W76-05966 5D	Process and the Nature of Inhibition,
bility Studies of the Soil, W76-06140 2J	Apparatus for the Treatment of Liquid Wastes,	W76-05784 5I
1170-00140	W76-05967 5D	INHIBITORS
INDIANA	3941	Inhibition of Scale Deposition,
Macrobenthic Population Dynamics in Indiana	Purification of Waste Water Containing Phthal-	W76-05529 5I
Waters of Lake Michigan in 1970, W76-05623 5C	ic Esters, W76-05982 5D	INJECTION WELLS
11.0.03023	3,0	Subsurface Disposal of Liquid Industria
Stream Pollution Control Board of State of In-	Method for Removing Soluble Selenium from	Wastes,
diana V. United States Steel Corp. (Common-	Acidic Waste Water, W76-05986 SD	W76-05573 51
Law Public Nuisance Action Against Steel Corp. in which Private Citizen Sought to Inter-	W76-05986 5D	INKS
vene.	Chemical Characterization of Industrial Waste-	Biological Treatment by a System of Activated
W76-06106 6E	waters by Gas Chromatography-Mass Spec-	Sludge Applied to the Effluent Waters of
THE CALL OF A	trometry, W76-06008 SA	Corrugated Board Plant,
INDONESIA Groundwater Study of a Volcanic Area Near	W76-06008 5A	W76-05713 51
Bandung, Java, Indonesia,	Environmental Protection Agency-Poultry	INLAND WATERWAYS
W76-05914 4B	Processing Products, Proposed Performance	The Role of Inland Navigation in River Basis
	and Pretreatment Standards.	Development,
INDUS PROJECT	W76-06096 5G	W76-05511 4A
Inter Basin Transfer of Water Resource Case Study of Indus Project,	INDUSTRIAL WATER	INORGANIC COMPOUNDS
W76-05753 4A	Synergistic Compositions Containing 2,2-	Sewage Treatment,
	Dibromo-3-Nitrilopropionamide and 3,3,4,4-	W76-05582 5I
INDUSTRIAL PLANTS	Tetrachlorotetrahydro-Thiopene-1,1-Dioxide	MINIST CHIEFLIN AND VOICE
Reforming Procedures for Industrial Siting, W76-06058	and Their Use, W76-05531 5F	INPUT-OUTPUT ANALYSIS An Economic Analysis of Water Use in
W76-06058 6E	W 10-05551	Colorado's Economy,
INDUSTRIAL WASTE	INDUSTRIES	W76-05837 6I
Process for the Treatment of Mineral Slimes,	Industrial Cost Recovery and User Charge As-	
W76-05973 5D	sessments,	INSECT CONTROL
INDUSTRIAL WASTES	W76-05813 5G	Breeding Places and Seasonal Incidence of Aedes Aegypti, as Assessed by the Single
Process for Biochemical Reactions,	An Economic Model of Water Use and Waste	Larva Survey Method,
W76-05542 5D	Treatment,	W76-06033 50
Water and American Co. Co. Co.	W76-05814 5D	INSECTICIDES
Method and Apparatus for Centrifugally Separating Finely Divided Solids from Aqueous	Measuring and Minimizing the Social Cost of	Transfer of Lindane from Bark of Insecticide
Suspensions Thereof,	Environmental Pollution,	Sprayed Pine Pulpwood into Effluent from
W76-05543 5D	W76-05824 5G	Barking Drum (Lindaanin huuhtoutumisesta
Process for Conditioning Effluent Con-	The Economics of Clean Water. Volume III.	suojaruiskutetun mantykuitupuun kuoresta
taminated by Aldehyde Compounds,	Industry Expenditures for Water Pollution	rumpukuorimon jateveteen),
W76-05545 5D	Abatement.	W76-05734 5E
	W76-05951 5G	INSTITUTIONAL CONSTRAINTS
Filtering Apparatus and Process, W76-05546 5D	INFILTRATION	Institutional Constraints and Conjunctive
W76-05546 5D	Effect of Surface Applied Sulfuric Acid on	Management of Water Resources in Wes Texas,
Process for Treating Waste Water Containing	Water Penetration into Dry Calcareous and	W76-05842 6E
Cellulose Nitrate Particles,	Sodic Soils,	11.10 03012
W76-05575 5D	W76-05907 5G	INSTRUMENTATION
Environmental Aspects of the Use of Starches	Factors Influencing Infiltration and Sediment	Line Motion and Water Current Disc Sensor,
in the Paper Industry (Hlediska ochrany zivot-	Production of Semiarid Rangelands in Nevada,	W76-05539 7E
niho prostredi pri pouzivani skrobovych	W76-05912 2G	Stream Analyzers are for Waste as Well as
produktu v papirenskem prumyslu),	INFORMATION EXCHANGE	Product,
W76-05720 SB	Canadian Water Resources Information: A	W76-05596 5A
Transfer of Lindane from Bark of Insecticide-	Network Approach,	Design and Results of Comparative Tests of
Sprayed Pine Pulpwood into Effluent from a	W76-05952 10D	Rainfall Recorder Operating for a Weel
Barking Drum (Lindaanin huuhtoutumisesta	INFORMATION STORAGE AND RETRIEVAL	(WRR),
suojaruiskutetun mantykuitupuun kuoresta rumpukuorimon jateveteen),	Canadian Water Resources Information: A	W76-05674 7E
W76-05734 5B	Network Approach,	A Spectral Light Absorption Meter for Mea
•	W76-05952 10D	surements in the Sea,
The Economics of Clean Water. Volume III.	INHIBITION	W76-05680 7E
Industry Expenditures for Water Pollution Abatement.	Inhibition of Scale Deposition,	Water Level Gauge,
W76-05951 5G	W76-05529 5D	W76-05977 7F

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INTER-AGENCY COOPERATION

INTER-AGENCY COOPERATION Certification of Conformance with Water	Ion Exchanger for the Treatment of Waste Water,	Balanced Sprinkler Impact Drive, W76-05957 3F
Quality Standards.	W76-05962 5D	Water Movement Within the Root Zone of Ir-
W76-06066 5G	Method of Treating Waste Liquids from Photo-	rigated and Nonirrigated Grain Sorghum,
INTER-BASIN TRANSFERS	graphic Processings,	W76-05994 2G
Inter Basin Transfer of Water Resource Case Study of Indus Project,	W76-05963 5D	IRRIGATION PRACTICES
W76-05753 4A	Multi-Tank Ion Exchange Water Treatment	Impact Sprinkler,
	System,	W76-05956 3F
INTERBASIN DEVELOPMENT Systems Approach to River Basin and Inter-	W76-05975 5F	IRRIGATION PROGRAMS
basin Development,	Method of Operating Ion Exchange System,	Water Resources Development in the Ganga-
W76-05512 4A	W76-05983 5F	Ghagra Interbasin in Uttar Pradesh (India),
INTERMEDIATE REGIONAL FLOOD	Ion Exchange Technique for the Determination	W76-05763 4A
Flood Plain Information: Illinois and Michigan	of Chlorinated Phenols and Phenoxy Acids in	The International Law Aspects of the Garrison
Canal, Rock Run Creek, Thorne Creek, Joliet,	Organic Tissue, Soil, and Water, W76-06122 5A	Diversion Project,
Illinois. W76-05645 4A		W76-06053 6E
W 70-03043	Determination of Selenium in Natural Waters	Congress Orders Moritorium on Garrison
INTERNAL REFLECTIONS	Using the Centrifugal Photometric Analyzer, W76-06128 2K	Diversion Unit.
Internal Reflections in Polar Ice Sheets, W76-05681 2C	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	W76-06054 6E
W76-05681 2C	IONS	IRRIGATION SYSTEMS
INTERNATIONAL COOPERATION	Ionic Leaf Accumulation in Grapes, Guava and Olive Plants as Affected by the Salinity of Ir-	Water Line,
Goals and Forms of Co-operation Among	rigation Water,	W76-05541 3F
Countries for the Development of International River Basins,	W76-06030 3C	The Columbia Basin Project Reappraised,
W76-05521 4A	IOWA	W76-05750 4A
	Report on Water Quality and Waste-Source In-	
International River Basin Cooperation: Some Factors Influencing Agreement,	vestigations, Big Sioux River and Selected	IRRIGATION WATER
W76-05758 6E	Tributaries. W76-05626 5C	Occurrence of Phytophthora Species and Other Potential Plant Pathogens in Recycled Irrigation
I and England of Co. On ordina in the Field	W 76-03626	Water,
Legal Framework of Co-Operation in the Field of Water Management Between Hungary and	IRELAND	W76-06010 5C
Her Neighboring Countries,	Eutrophication of an Inland Lake in Ireland in	ISOTOPE STUDIES
W76-05759 6E	Association with the Intensification of Pig Farming in the Catchment Areas,	Isotopic Study of Hail,
INTERNATIONAL HYDROLOGICAL DECADE	W76-05629 5C	W76-05665 2B
Nuclear Techniques in HydrologyCurrent	IRON	Nuclear Techniques in Hadrolous Comen
Status and Prospective Uses.	Vyredox-In Situ Purification of Ground Water,	Nuclear Techniques in HydrologyCurrent Status and Prospective Uses.
W76-05922 5A	W76-05553 5F	W76-05922 5A
INTERNATIONAL JOINT COMMISSION	Examination and Removal of Iron in Ground-	TACRER ADDITER (LA)
The International Law Aspects of the Garrison	water,	JASPER AQUIFER (LA) Geohydrology of the Evangeline and Jasper
Diversion Project, W76-06053 6E	W76-05571 5B	Aquifers of Southwestern Louisiana,
W 70-00033	Removal of Copper and Iron Prior to Water	W76-05861 2F
INTERNATIONAL LAW	Hardness Titration,	JAVA
International River Basin Cooperation: Some	W76-05716 5A	Groundwater Study of a Volcanic Area Near
Factors Influencing Agreement, W76-05758 6E	IRON BACTERIA	Bandung, Java, Indonesia,
	Examination and Removal of Iron in Ground-	W76-05914 4B
Congress Orders Moritorium on Garrison	water,	JUDICIAL DECISIONS
Diversion Unit. W76-06054 6E	W76-05571 5B	State V. Griffith (Private Claim to Tidelands).
	IRRIGATION	W76-06087 6E
INTERNATIONAL WATERS	Water Line,	Williams V. Duke Power Co. (Silting of Stream,
Urban Water Management of an International River: The Case of El Paso -Juarez,	W76-05541 3F	Ponds, and Lake).
W76-05661 3D	Allowance for Precipitation and Runoff Fluc-	W76-06088 6E
ION EVOUANCE	tuation Patterns in Computing Water	Lingo V. City of Jacksonville (Authority of
ION EXCHANGE Buffered, Weak Ion-Exchange Water	Withdrawal for Irrigation Systems in the	City to Pump Subterranean Water).
Demineralization Process,	Southern Ukraine, W76-05675 4A	W76-06092 6E
W76-05526 3A	The second secon	Caldwell V. Goldberg (Discharge of Effluent
Detection Devices for Use in Solution	Inter Basin Transfer of Water Resource Case	from Sewage Plant into Drainage Ditch).
Processing Systems,	Study of Indus Project, W76-05753 4A	W76-06093 6E
W76-05532 5F		Oliver V Hule (Territories of W.
Use of Ion Exchangers and Synthetic Sorbents	Pond and Irrigation Systems Offer Economy	Oliver V. Hyle (Termination of Water and Sewer Services for Failure to Pay Arrearages
for Removal of Color from Kraft Process ef-	and Flexibility, W76-05774 5D	Denial of Due Process).
fluents (Proby zastosowania jonitow i sor-		W76-06094 6E
bentow syntetycznych do usuwania barwy ze	Design, Operation, and Monitoring of Mu-	Upper Harmony Ditch Co. V. Carwin
sciekow posiarczanosych), W76-05698 5D	nicipal Irrigation Systems, W76-05783 5E	(Treasurer's Deed Incapable of Extinguishing
		Ditch Easement and Water Rights Under War-
Nitrate Removal from Water by Ion Exchange, W76-05806 5F	Impact Sprinkler,	ranty Deed).
W76-05806 5F	W76-05956 3F	W76-06101 6E

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Reserve Mining Co. V. Environmental Protec-	LABORATORY TESTS	LAKE SEDIMENTS
tion Agency (Action by U. S. and Minnesota to	The Permittivity and Attenuation in	Stable Lead Geochronology of Fine-Grained
Prevent Discharge of Taconite Tailings into	Polycrystalline and Single-Crystal Ice Ih at 30 and 60 MHz,	Sediments in Southern Lake Michigan, W76-05884
Water of Lake Superior by Processing Com-	W76-05672 2C	W76-05884 5B
pany). W76-06107 6E	11 70-03072	Geochronology of Lake Michigan Sediments:
W76-06107 6E	LAGOONS	Anomalies in Lead-210 Distributions,
United States V. Lewis (Action to Enjoin Con-	Biomass Distribution and Kinetics of Baffled	W76-05885 5B
struction of a Causeway across a Tidal Marsh	Lagoons,	W 10 0000
without Permit Required Under the Rivers and	W76-05590 5D	Sedimentary Pu-239, Pu-240 Phase Distribu-
Harbors Act).		tions in Lake Michigan Sediments,
W76-06108 6E	LAKE BEDS	W76-05891 5B
***************************************	Nematodes of Lake Balaton: IV. Seasonal	
United States V. Florida (Proceeding Seeking	Qualitative and Quantitative Changes,	The Distribution of Plutonium in Lake
Definition of Seaward Boundary of Submerged	W76-06004 5C	Michigan Sediments,
Lands of Continental Shelf).	LAKE ERIE	W76-05892 5B
W76-06109 6E	Mercury Occurrence in Sediment Cores from	Manuary in Codiments of the Harman Busht
	Western Lake Erie,	Mercury in Sediments of the Horwer Bucht
Butler V. Bruno (Deflection of Surface	W76-06137 5B	(Lake Lucerne) and Tributary Streams, Swit- zerland,
Waters).		W76-06136 5A
W76-06110 6E	LAKE EVERGREEN (ILL.)	W/6-00136 3A
State V CNi- S11 C1 C-	Chemistry of Mud-Water Interface in an Im-	Mercury Occurrence in Sediment Cores from
State V Corvallis Sand and Gravel Co.	poundment,	Western Lake Erie,
(Avulsion: Newly Submerged Lands Title in	W76-05630 5C	W76-06137 5B
Former Owner But Paramount Navigational		11 10 00131
Servitude in State).	LAKE GEORGE (N.Y.)	LAKE SUIGETSU (JAPAN)
W76-06111 6E	A Description of the Trophic Status and	Changes in the Limnological Features of a
City of Las Angeles V. Bisands (Flood Destrue	Nutrient Loading for Lake George, New York,	Meromictic Lake Suigetsu During the Years,
City of Los Angeles V. Ricards (Flood Destruc-	W76-05638 5C	1926-1967.
tion of Private Bridge Causes Loss of Access	I AVE VINNEDET (ICD API)	W76-06018 2H
and Depreciation of Property Value-Inverse	LAKE KINNERET (ISRAEL)	
Condemnation).	Phosphorus, Nitrogen, and the Growth of	LAKE TROUT
W76-06112 6E	Algae in Lake Kinneret,	Comparative Toxicity of Polyelectrolytes to
Goose Creek Hunting Club, Inc. V. United	W76-05633 5C	Selected Aquatic Animals,
States (Damages for Government's Taking of	LAKE LUCERNE (SWITZERLAND)	W76-05740 5C
Permanent Flowage Easement).	Mercury in Sediments of the Horwer Bucht	
W76-06114 6E	(Lake Lucerne) and Tributary Streams, Swit-	LAKE WINGRA (WISC)
W.0-00114 6E	zerland,	Lake Wingra, 1837-1973: A Case History of
CANSAS	W76-06136 5A	Human Impact,
Trace Element, Mineralogy, and Size Distribu-	77 00130	W76-05997 5C
tion of Suspended Material Samples from	LAKE MICHIGAN	
Selected Rivers in Eastern Kansas,	Macrobenthic Population Dynamics in Indiana	LAKES
W76-05606 5B	Waters of Lake Michigan in 1970,	Evaluation of the Trophic Types of Several
35	W76-05623 5C	Alaskan Lakes by Assessment of the Benthic
Development and Field Testing of a Basin		Fauna,
Hydrology Simulator,	Lake and Shore Ice Conditions on Southeast-	W76-05604 5C
W76-05745 2A	ern Lake Michigan in the Vicinity of the	
	Donald C. Cook Nuclear Plant: Winter 1973-74,	Eutrophication of an Inland Lake in Ireland in
KENTUCKY	W76-05664 2C	Association with the Intensification of Pig
Supply and Demand in Water Planning:	Role of Copepod Fecal Pellets in the Vertical	Farming in the Catchment Areas,
Streamflow Estimation and Conservational	Transport of Freshwater Diatoms,	W76-05629 5C
Water Pricing,	W76-05880 . 5C	Chemically Enhanced C02 Gas Exchange in a
W76-05607 6D	W 70-03880	Eutrophic Lake: A General Model,
	LAKE NORMAN (NC)	W76-05635 SC
Some of the Effects of Domestic Sewage	Environmental Responses to Thermal	W 76-03633
Discharge into Hickman and Jessamine Creeks	Discharges from Marshall Steam Station, Lake	A Description of the Trophic Status and
in Jessamine County, Kentucky,	Norman, North Carolina,	Nutrient Loading for Lake George, New York,
W76-05841 5B	W76-05870 5C	W76-05638 5C
ZII I IEIGIEG		
KILLIFISHES	Introduction and Physical Description of Lake	Development of Oxygen Deficits in 14
Differential Responses to Drought in Two Spe-	Norman,	Southern Ontario Lakes,
cies of Fundulus,	W76-05871 5C	W76-05679 50
W76-06132 2H	Theres I and Water Couling Characteristics of	
PANERWAGO	Thermal and Water Quality Characteristics of	Effect of Environmental Factors on Standing
KINETICS	Lake Norman, W76-05872 5C	Crop of Plankton in British Columbia Lakes,
Biomass Distribution and Kinetics of Baffled	W76-05872 5C	W76-05741 50
Lagoons,	Plankton Populations,	
W76-05590 5D	W76-05873 5C	Selected Water-Quality Data from Fallen Lea
VIELDARI NITROCEN		Lake, El Dorado County, California, June
KJELDAHL NITROGEN	The Effect of Thermal Discharge on the Rate	through October 1974,
On the Possibilities of Averaging the Seasonal	of Accumulation of Organic Substances on	W76-05848 70
Pattern in Kjeldahl Nitrogen in a Group of	Glass Surfaces Immersed in Lake Norman,	Introduction and Physical Description of Lake
Water Bodies, W76-06019 5B	W76-05875 5C	
W76-06019 5B	note to a toron	Norman, W76-05871 50
LABORATORY EQUIPMENT	Benthic Invertebrates,	W76-05871 30
Detachment of Pendant Water Drops by High	W76-05877 5C	Nematodes of Lake Balaton: IV. Seasona
Voltage Pulses,	Fisheries Research,	Qualitative and Quantitative Changes,
W76-05917 2B	W76-05878 5C	W76-06004 50
20		

2B

5C

Macrovegetation and Ecological Factors in Two Norwegian Lakes, W76-06044 5C	Timber Production and Water Quality Progress in Planning for the Bull Run, Portland, Oregon's Municipal Watershed, W76-05942 5B	Compilation of Methodology used for Measur- ing Pollution Parameters of Sanitary Landfill Leachate, W76-05869 5A
Story V. Hefner (Deeds Purporting to Divide		
Lake in Half Ineffective to Prohibit Use of En- tire Surface for Recreational Purposes).	Reforming Procedures for Industrial Siting, W76-06058 6E	LEACHING Leaching Polyelectrolyte Fluidized Solids,
W76-06102 6E	Suggested Provisions to Be Used in Zoning Or-	W76-05536 5D
Generic Composition and Nutritional Requirements of Bacteria Isolated from Three Lakes, W76-06120 2H	dinances for Compliance with Sections 1910.3(C) of the National Flood Insurance Program.	Salt Transport in Soil Profiles with Application to Irrigation Return Flow, The Dissolution and Transport of Gypsum in Soils,
LAMINAR FLOW	W76-06060 6F	W76-05836 5B
Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent	LANDFILLS Protecting Groundwater from Landfill	Compilation of Methodology used for Measur- ing Pollution Parameters of Sanitary Landfill
Flows,	Leachate,	Leachate,
W76-05924 8B	W76-05599 5G	W76-05869 5A
LAMPREYS	Effective Use of High Water Table Areas for	Solute Travel-Time Estimates for Tile-Drained
Glucuronide Formation in Rainbow Trout: Effect of Salicylamide on the Acute Toxicity,	Sanitary Landfill. Vol. II, W76-05744 5G	Fields: I. Theory, W76-05904 5B
Conjugation and Excretion of 3-		Solute Travel-Time Estimate for Tile-Drained
Trifluoromethyl-4-Nitrophenol, W76-06031 5C	Compilation of Methodology used for Measur- ing Pollution Parameters of Sanitary Landfill	Fields: II. Application to Experimental Studies, W76-05905 5B
LAND CLASSIFICATION	Leachate, W76-05869 SA	W 70-03703
LAND CLASSIFICATION Suggested Provisions to Be Used in Zoning Or-	W76-05869 5A	Reclamation of Soils Contaminated with
dinances for Compliance with Sections	Thermal Processing and Land Disposal of Solid Waste.	Radioactive Strontium, W76-05906 5G
1910.3(C) of the National Flood Insurance Program.	W76-06082 5D	
W76-06060 6F	In Re: Marine Equities Corp. V. Biggane (Tidal	Stable Lead Geochronology of Fine-Grained
LAND MANAGEMENT	Wetland Act Constitutional as Applied to Ap-	Sediments in Southern Lake Michigan, W76-05884 5B
Timber Production and Water Quality Progress in Planning for the Bull Run, Portland,	plication for Permit to Fill Under Water Land Off Staten Island).	
Oregon's Municipal Watershed,	W76-06100 6E	Geochronology of Lake Michigan Sediments: Anomalies in Lead-210 Distributions,
W76-05942 5B	LANDSLIDES	W76-05885 5B
LAND RECLAMATION	Impact of Clear-Cutting and Road Construction	LEACT COLLARS METHOD
Precipitation Management for Reclamation of Overgrazed Areas in Arid and Semi-Arid Re-	on Soil Erosion by Landslides in the Western Cascade Range, Oregon,	LEAST SQUARES METHOD Determining Aquifer Coefficients from
gions,	W76-05614 4C	Residual Drawdown Data, W76-05689 2F
W76-05603 2B	LARVICIDES	
Reclamation of Soils Contaminated with	Glucuronide Formation in Rainbow Trout: Ef-	LEAVES
Radioactive Strontium, W76-05906 5G	fect of Salicylamide on the Acute Toxicity, Conjugation and Excretion of 3-	Ionic Leaf Accumulation in Grapes, Guava and Olive Plants as Affected by the Salinity of Ir- rigation Water,
	Trifluoromethyl-4-Nitrophenol,	W76-06030 3C
LAND SUBSIDENCE	W76-06031 5C	
Land Subsidence and Aquifer-System Compac-	LARVIVOROUS FISH	LEGAL ASPECTS
tion in the San Jacinto Valley, Riverside Coun- ty, CaliforniaA Progress Report, W76-05847 2F	Effect of Running Water on the Predatory Effi- ciency of the Larvivorous Fish Cambusia Af-	Legal Framework of Co-Operation in the Field of Water Management Between Hungary and
	finis,	Her Neighboring Countries, W76-05759 6E
LAND USE	W76-06021 2I	
Water Resources Development in the Tisza	LATVIAN SSR	The Taking Issue: Potential Obstacle to natural
River Basin and Its Impact on Socio-Economic Growth,	Flood Routing in Channel Systems with Al-	Resource Management Legislation, W76-06055 6E
W76-05519 4A	lowance for Bank Regulation,	
	W76-05668 4A	LEGAL REVIEW
Relationships Between Drainage Area Charac- teristics and Non-Point Source Nutrients in	LAURENTIDE ICE SHEET	Legislative Bargain and the Doctrine of Repeal by Implication (Discussion of Case Involving
Streams.	Collapse of the Hudson Bay Ice Center and	Colorado River Storage Act).
W76-05624 5B	Glacio-Isostatic Rebound, W76-05669 2C	W76-06052 4A
Flood Hazard Analyses: Blacks Run-Cooks		LEGISLATION
Creek, Rockingham County and Harrisonburg,	LAW OF THE SEA	Detergent Phosphate Ban Yields Little
Virginia. W76-05644 4A	The Economics of Alternative Deep Seabed Regimes,	Phosphorus Reduction, Part I, W76-05637 5C
How to Guide Growth in Southeastern New	W76-05816 6E	The Safe Drinking Water Act of 1974: A
England, Parts I, II and IV of the Draft Report.	LEACHATE Protecting Groundwater from Landfill	Management Impact Statement.
W76-05649 6G	Leachate,	W76-05656 5G
Hanlon Creek Ecological Study, Phase B.	W76-05599 5G	Effluent Discharge Law-Burdens and Con-
W76-05650 6G	Effective Use of High Water Table Areas for	sequences for the Paper Industry
Perspective 75.	Sanitary Landfill. Vol. II,	(Abwasserabgabengesetz-Belastungen und Fol- gerungen fuer die Papierindustrie),
W76-05651 6B	W76-05744 5G	W76-05712 5G

ir-A

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Con-stry Fol-

5G

Legislative Bargain and the Doctrine of Repeal	LIMNOLOGY	LONG ICLAND (NV)
by Implication (Discussion of Case Involving	Thermal and Water Quality Characteristics of	LONG ISLAND (NY)
Colorado River Storage Act).	Lake Norman,	Hydrogeochemical Data from Investigation of
W76-06052 4A		Water Quality in Sewered and Unsewered Areas, Southern Nassau County, Long Island,
W 70-00032	W 70-03672	New York.
The Washington Shoreline Management Act,	Plankton Populations,	W76-05858 7C
W76-06056 5G	W76-05873 5C	11 10 05 05 0
		LONG-TERM PLANNING
Certain Land Use Regulations to Protect from	Primary Production,	Long Range Planning of Water Resources: A
Danger of Flooding.	W76-05874 5C	Multi Objective Approach,
W76-06059 6F	LINEAR PROGRAMMING	W76-05760 6A
South Dakota Environmental Policy Act.	The Out-Of-Kilter Algorithm and Some of its	LONG TURN UPDATE A DIGITAL AND A
W76-06075 5G	Applications in Water Resources,	LONG-TUBE VERTICAL DISTILLATION
	W76-05515 6A	Operation of Pilot Plant LTV Evaporator at
Submerged Lands Legislation Affecting Guam,	W 70-05515	Wrightsville Beach, North Carolina. W76-06049 3A
The Virgin Islands, and American Samoa (HR	An Economic Model of Water Use and Waste	W76-06049 3A
11559).	Treatment,	LOUGH SHEELIN (IRELAND)
W76-06080 6E	W76-05814 5D	Eutrophication of an Inland Lake in Ireland in
To Amend the Wild and Scenic Rivers Act (on		Association with the Intensification of Pig
S. 10 and S. 1004).	LIQUID WASTES	Farming in the Catchment Areas,
W76-06081 6E	Evaporator-Condenser Unit for Producing	W76-05629 5C
W 70-00001	Potable Water From Sewage,	
Obstruction of Streams or Lakes by Fyke Nets	W76-05960 5D	LOUISIANA
or Other Devices.	LITHIFICATION	ERDA's Tiger Lagoon Program to Probe New
W76-06089 6E	Guidelines for Characterizing Naturally Unsta-	Energy Source.
	ble or Potentially Unstable Slopes on Western	W76-05568 8A
Marine Conservation Act, Amendments.	National Forests,	Geohydrology of the Evangeline and Jasper
W76-06091 6E	W76-05621 4D	Aquifers of Southwestern Louisiana,
LEMNA		W76-05861 2F
LEMNA Statistical Study of the Duckweed Rhizosphere	LITTER	11.5-05001 2F
as an Eco-Assay Tool,	Emory Oak (Quercus Emoryi) Litter Phenolics	Obstruction of Streams or Lakes by Fyke Nets
W76-05605 5B	as Environmental Hazards for Aquatic Animals	or Other Devices.
W 70-03003	in Southeastern Arizona,	W76-06089 6E
LETHAL LIMIT	W76-06125 5B	
Comparative Toxicity of Polyelectrolytes to		LOW FLOW
Selected Aquatic Animals,	LITTLE ARKANSAS RIVER (KAN)	Dependable Yield of Reservoirs with Intermit-
W76-05740 5C	Development and Field Testing of a Basin	tent Inflows,
	Hydrology Simulator, W76-05745 2A	W76-05908 4A
Acute Toxicity of a Native Mummichog Popu-	W76-05745 2A	LOWER MEKONG BASIN (THAILAND)
lation (Fundulus Heteroclitus) to Mercury,	LITTORAL	Multipurpose River Project Planning in the
W76-05742 5C	Effects of a Tropical Cyclone on Littoral and	Lower Mekong Basin: A Decision Approach,
LIGHT ABSORPTION METER	Sub-Littoral Biotic Communities and on a	W76-05762 6A
	Population of Dugongs (Dugong Dugon	W 70-05702
A Spectral Light Absorption Meter for Mea- surements in the Sea,	(Muller)),	LUMBER
W76-05680 7B	W76-06131 2L	Timber Products Processing Point Source
170-03000		CategoryEffluent Guidelines and Standards.
LIGHT INTENSITY	LIVEBEARS	W76-06085 5G
A Spectral Light Absorption Meter for Mea-	Effect of Running Water on the Predatory Effi-	
surements in the Sea,	ciency of the Larvivorous Fish Cambusia Af-	LUMBERING
W76-05680 7B	finis,	The Impact of Timber Harvest, Fertilization,
LEGNING	W76-06021 2I	and Herbicide Treatment on Streamwater
LIGNINS	LIVESTOCK	Quality in Western Oregon and Washington,
Electrolytic Coagulation of Lignin from Kraft	Nebraska Livestock Waste Control Regula-	W76-05618 5B
Mill Bleach Plant Wastewaters,	tions.	Timber Production and Water Quality -
W76-05708 5D	W76-06079 5G	Progress in Planning for the Bull Run, Portland,
LIME		Oregon's Municipal Watershed,
Chemical Precipitation of Wastewaters with	LOAM	W76-05942 5B
Lime (Kemisk fallning av avloppsvatten med	Spatial Variability of in Situ Unsaturated	
kalk),	Hydraulic Conductivity of Maddock Sandy	Slope Stability Problems Associated with
W76-05585 5D	Loam,	Timber Harvesting in Mountainous Regions of
	W76-05670 2G	the Western United States,
Lime-Induced Reactions in Municipal Waste-		W76-05944 4C
waters,	LOCAL SCOUR	1 VCIMETEDS
W76-05597 5D	A Stable Numerical Model for Local Scour,	LYSIMETERS Ratio Between Evapotranspiration from
Lime Decovery and Penes in Drimery Toron	W76-05666 2J	Ratio Between Evapotranspiration from Lysimeters and Evaporation from Small
Lime Recovery and Reuse in Primary Treat-	LOGGING (RECORDING)	Evaporimeters Using 2- and 3- hour Periods of
ment, W76-05785 5D	Careful Sample Taking is Key to Successful	Measurement.
W 10-03/63	Wells,	W76-06029 2D
Lime Use in Wastewater Treatment: Design	W76-05560 4B	
and Cost Data,		MAGNESIUM
W76-05868 5D	A Driller's Good Friend - The Electric Logger,	Studies on the Ca, Mg, and Sr Content of
	W76-05561 8G	Freshwater Clamshells,
LIMITING FACTORS	LOGUADALLA BIORRIA	W76-06119 2H
Productivity and Biochemical Composition of	LOGNORMAL DISTRIBUTION	A. A. TAITEDAY A NOTE
Chlorella at Different Levels of Illumination	Continuous Seasonal Probability of Extreme	MAINTENANCE
and Nitrogen Limitation,	Rainfall Events,	Rig Restoration. W76-05555 8G
W76-05640 5C	W76-05692 2B	W76-05555 8G

MAINTENANCE

Toronto's Approach to Preventive Maintenance for Treatment Plants, W76-05780 5F	MARKING TECHNIQUES Origin of Fin-Clipped Salmonids Collected at Two Thermal Discharges on Lake Michigan,	Steady-State Segmented Dissolved-Oxyger Model, W76-05855 SE
Upper Harmony Ditch Co. V. Carwin	W76-05895 5C	MATHEMATICS
(Treasurer's Deed Incapable of Extinguishing Ditch Easement and Water Rights Under War- ranty Deed).	Characteristics of Temperature-Sensitive Fish Tags Used in 1974, W76-05897 5C	Normal Mode Analysis of the Linear Equation of Groundwater Flow, W76-05685 21
W76-06101 6E		
MANAGEMENT	Discharge Residence of TLD Tagged Fish, W76-05898 5C	MEANDERS Hydraulic Computation of a Pool Hollow,
Optimal Groundwater Quality Management:		W76-05931 21
Well Injection of Waste Waters,	MARKOV PROCESSES Comment Upon Multivariate Synthetic	MEASUREMENT
W76-05507 5B	Hydrology,	Design and Results of Comparative Tests of
The Out-Of-Kilter Algorithm and Some of its	W76-05909 2A	Rainfall Recorder Operating for a Weel (WRR),
Applications in Water Resources, W76-05515 6A	MARSHALL STEAM STATION (NC)	W76-05674 7I
A Review of Some Hydrological Studies	Environmental Responses to Thermal	Monetary Values of Life and Health.
Required in the Design of Water Management	Discharges from Marshall Steam Station, Lake Norman, North Carolina,	W76-05812 61
Projects. W76-05517 4A	W76-05870 5C	Social Impact Assessment: An Analytic
	Plankton Populations,	Bibliography,
Recent Trends in Water Quality Management and Protection in Hungary,	W76-05873 5C	W76-05820 61
W76-05518 5G	Primary Production,	A Technique for Environmental Decision Mak
Criteria for Evaluation of Social Impacts of	W76-05874 5C	ing Using Quantified Social and Aesthetic Values,
Flood Management Alternatives,	Zooplankton Entrainment,	W76-05825 50
W76-05653 6B	W76-05876 5C	MELTING
Real-Time Management of Water-Resource	MARSHES	The Movement of Melting Ice over Rough Sur
Systems,	Relation of Water Level and Fish Availability	faces,
W76-05747 6A	to Wood Stork Reproduction in the Southern Everglades, Florida,	W76-05671 20
International Management of the River Plate Basin,	W76-05850 21	Snow Accumulation and Melting in the Fores and in Clear-Cut Areas in the Central Ural,
W76-05756 4A	MASS SPECTROSCOPY	W76-05929 20
Flood Loss Management in Developing Coun-	Chemical Characterization of Industrial Waste-	MEMBRANE PROCESSES
tries: A Model for Identifying Appropriate	waters by Gas Chromatography-Mass Spectrometry,	Effect of the Operational Temperature in Reverse Osmosis Method (Gyaku shinto ho n
Strategies, W76-05761 6A	W76-06008 5A	okeru sosa ondo no eikyo),
	MASS WASTING	W76-05592 5I
WANGANESE Vyredox-In Situ Purification of Ground Water, W76-05553 5F	Geology and Geomorphology of the H. J. Andrews Experimental Forest, Western Cascades, Oregon,	Desalination Process by Improved Multistage Electrodialysis,
	W76-05941 4D	W76-05980 3A
MANGROVE SWAMPS The Fauna of Careel Bay with Comments on	The Forest Ecosystem of Southeast Alaska 5.	Reverse Osmosis Separation Apparatus,
the Ecology of Mangrove and Sea-Grass Com- munities,	Soil Mass Movement, W76-05950 4D	W76-05990 3A
W76-06022 2L	W 76-03930 4D	Apparatus for the Separation of Liquid Mix tures My Means of Permeability Selective
Effects of a Tropical Cyclone on Littoral and	MASSACHUSETTS	Separation Membranes,
Sub-Littoral Biotic Communities and on a	Evaluation of Data Availability and Examples of Modeling for Ground-Water Management on	W76-05991 3A
Population of Dugongs (Dugong Dugon	Cape Cod, Massachusetts,	MEMBRANES
(Muller)), W76-06131 2L	W76-05856 4B	Reverse Osmosis Separation Apparatus,
	MATALAS ALGORITHM	W76-05990 3A
MANGROVES Effects of a Tropical Cyclone on Littoral and	Comment Upon Multivariate Synthetic	MERCURY
Sub-Littoral Biotic Communities and on a	Hydrology, W76-05909 2A	Interactions of Mercury with Aquatic and Edaphic Environments,
Population of Dugongs (Dugong Dugon	MATHEMATICAL MODELS	W76-05601 SE
(Muller)), W76-06131 2L	MATHEMATICAL MODELS River Basin Models and Their Application with	Rapid Photochemical Decomposition of Or
	Scarcity of Data.	ganic Mercury Compounds in Natural Water,
MAPS Floridan Aquifer in Northeast FloridaThree	W76-05516 4A	W76-05715 5A
MapsHardness of Water, Chloride Concentra- tion, and Potentiometric Surface, May 1974,	Vertical Distribution of Nitrate Concentration in Interstitial Water of Marine Sediments with	Acute Toxicity of a Native Mummichog Population (Fundulus Heteroclitus) to Mercury
W76-05859 7C	Nitrification and Denitrification, W76-05678 5B	lation (Fundulus Heteroclitus) to Mercury, W76-05742
Maps of the Elements of the Hydrologic		Nature and Stability of Complex Mercury
Budget of Asia, W76-05934 2A	An Identification Approach to Subsurface Hydrological Systems,	Compounds in Surface and Ground Waters Phase II,
MARINE BIOLOGY	W76-05688 2F	W76-05838 5A
Subtidal Marine Biology of California, with Emphasis on the South,	Development and Field Testing of a Basin Hydrology Simulator,	The Reliability of Mercury Analysis in En vironmental Materials,
W76-06023 21	W76-05745 2A	W76.06007

Mercury in Sediments of the Horwer Bucht	Plutonium Concentrations in Water and	MISCIBLE DISPLACEMENT
(Lake Lucerne) and Tributary Streams, Switzerland,	Suspended Sediment from the Miami River Watershed, Ohio,	
W76-06136 5A	W76-05887 5B	Fields: I. Theory, W76-05904 5B
Mercury Occurrence in Sediment Cores from Western Lake Erie,	Plutonium in Aquatic Biota of the Great Miami River Watershed, Ohio,	Solute Travel-Time Estimate for Tile-Drained Fields: II. Application to Experimental Studies,
W76-06137 5B	W76-05888 5C	W76-05905 5B
MEROMICTIC LAKES	MICHIGAN	MISSISSIPPI
Changes in the Limnological Features of a	Michigan Wastewater Reporting and Surveil-	A Rural Mississippi Success Story: Alcorn
Meromictic Lake Suigetsu During the Years,	lance Fees Rules.	County's Water System.
1926-1967,	W76-06067 5G	W76-05657 6D
W76-06018 2H	Michigan Water Resources Commission Act.	Fallout CS-137: A Tool in Conservation
MESH GRADATION	W76-06068 5G	Research,
Finite Element Mesh Gradation for Surface	Eurasian Water-Milfoil in Michigan,	W76-05690 2J
Waves, W76-05919 8E	W76-06149 5G	MISSISSIPPI MARINE CONSERVATION
-	MIGRATION	COMMISSION
METAL RECOVERY	Further Observations on the Migration of Gam-	Marine Conservation Act, Amendments.
Liquid Purifying Process, W76-05528 5D	marus Zaddachisexton (Crustacea, Amphipoda) in a French Stream,	W76-06091 6E
	W76-06046 21	MISSISSIPPI RIVER BASIN
METALS Trace Flowert Mineraless and Size Distribu	Michaelova	The 1973 Mississippi River Basin Flood: Com-
Trace Element, Mineralogy, and Size Distribu- tion of Suspended Material Samples from	MIGRATION PATTERNS Origin of Fin-Clipped Salmonids Collected at	pilation and Analyses of Meteorologic, Stream-
Selected Rivers in Eastern Kansas,	Two Thermal Discharges on Lake Michigan,	flow, and Sediment Data, W76-05860 2E
W76-05606 5B	W76-05895 5C	
Second Annotated Bibliography on Biological	MIGRATORY PATTERNS	MISSISSIPPI RIVER FLOOD (1973)
Effects of Metals in Aquatic Environments,	Comparison of the Movement and Recapture of	The 1973 Mississippi River Basin Flood: Com- pilation and Analyses of Meteorologic, Stream-
W76-05863 5C	Salmonid Fishes Tagged at Two Power Plants,	flow, and Sediment Data,
METHANOLIC WASTE WATER	W76-05894 5C	W76-05860 2E
Biodegradation of Methanolic Waste Water,	MINCHINIA-NELSONI	MITES
W76-05525 5D	Epizootiology of Minchinia Nelsoni in Susceptible Wild Oysters in Virginia, 1959 To	The Influence of Dissolved Oxygen Concentra-
METHODOLOGY	1971,	tions on Three Species on Water Mites
Decision Perspectives on Urban Storm Water	W76-06035 5C	(Hydracarina), W76-06133 5C
Pollution,	MINE WASTES	W 76-06133
W76-05509 5D	Process for the Treatment of Mineral Slimes,	MIXED-INTEGER PROGRAMMING MODEL
Plan Formulation and Evaluation Studies	W76-05973 5D	Application of Multi-Regional Planning Models
Recreation. Vol. II of V. Estimating Initial	Reserve Mining Co. V. Environmental Protec-	to the Scheduling of Large-Scale Water Resource Systems Development,
Reservoir Recreation Use, W76-05611 6B	tion Agency (Action by U. S. and Minnesota to	W76-05846 6A
	Prevent Discharge of Taconite Tailings into	MIXING
Utah's Third Year of Planning for the Four	Water of Lake Superior by Processing Com- pany).	Study of Turbine Mixers for Flow-Through
Corners Regional Commission, W76-05827 6B	W76-06107 6E	Flocculation Chambers (Vyzkum turbinovych
	MINE WATER	michadel pro prutocne flokulacni komory),
Multi-Objective Water Resources Planning Methodology to Achieve Compatibility	Method of Reducing Sludge Accumulation	W76-05703 5D
Between Environmental Amenities and	from Tar Sands Hot Water Process,	Estimate of the Rate of Turbulent Mixing of
Economic Development,	W76-05965 5D	the Fluid in Wind-Driven Currents from the
W76-05840 6B	MINERAL SLIMES	Results of Moving and Still Particle Photog- raphy,
METHYLMERCURY	Process for the Treatment of Mineral Slimes,	W76-05932 8B
Nature and Stability of Complex Mercury	W76-05973 5D	MIXING ZONE
Compounds in Surface and Ground Waters,	MINERALOGY	South Dakota Water Quality Standards.
Phase II, W76-05838 5A	Trace Element, Mineralogy, and Size Distribu-	W76-06076 5G
	tion of Suspended Material Samples from Selected Rivers in Eastern Kansas,	
MEUSE RIVER	W76-05606 5B	MODEL PARAMETER ESTIMATES Using Parametric Models of Runoff to Improve
Contamination of Freshwater by Mn54 and Co60,	MINING	Parameter Estimates for Stochastic Models,
W76-05903 . 5C	The Economics of Alternative Deep Seabed	W76-05911 2E
MEXICO	Regimes,	MODEL STUDIES
Urban Water Management of an International	W76-05816 6E	QUURM - A Realistic Urban Runoff Model,
River: The Case of El Paso -Juarez,	MINNESOTA	W76-05577 2A
W76-05661 3D	Report on Water Quality and Waste-Source In-	Lime-Induced Reactions in Municipal Waste-
Principal Economic Aspects of the Problem of	vestigations, Big Sioux River and Selected Tributaries.	waters,
Salinity of the Colorado River,	W76-05626 SC	W76-05597 5D
W76-05821 6E	MIREX	Optimal Design Model for Waste Water Collec-
MIAMI RIVER WATERSHED PROJECT (OHIO)	Mirex Residues in Selected Estuaries of South	tion System (II) (Gesuidokan kiyo keikaiu no
Miami River Watershed Project: Introduction, W76-05886 5B	Carolina: June 1972,	saitekika moderu to sono oyo (II)), W76-05598 5D
W76-05886 5B	W76-05954 5A	W76-05598 5D

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Plants be Dimensioned. (Fuer Welche Belastung Sollen Kommunale Klaeranlagen	Fecundity of the Brown Bullhead, Ictalurus Nebulosus (Le Sueur) in a Mine Acid Polluted	Multipurpose River Project Planning in the Lower Mekong Basin: A Decision Approach,
Bemessen Werden), W76-05609 5D	River, W76-05641 81	W76-05762 6A
Nomograms for Simplified Hydraulic Dimen-	MONTANA	MULTIPLE-PURPOSE RESERVOIRS Real-Time Management of Water-Resource
sioning of Waste Water Ducts (Nomogramme	Water-Resources Investigations of the U.S.	Systems,
Zur Vereinfachten Hydraulischen Bemessung	Geological Survey in the Northern Great Plains	W76-05747 6A
Von Abwasser-Kanaelen), W76-05610 5D	Coal Region of Eastern Montana, 1975-76, W76-05853 7C	миммісноб
		Acute Toxicity of a Native Mummichog Popu-
Nutrient Cycling in 37- and 450-Year-Old Douglas-Fir Ecosystems, W76-05619 5B	MONTREAL (MIRABEL INT'L AIRPORT) Quebec's Water and Sewage Masterplan for Mirabel Region.	lation (Fundulus Heteroclitus) to Mercury, W76-05742 5C
	W76-05793 5D	MUNICIPAL-INDUSTRIAL WASTE
Chemically Enhanced C02 Gas Exchange in a Eutrophic Lake: A General Model,	MARRIMENT POTTI AND ALOGAMENTO.	TREATMENT
W76-05635 5C	MORRUMBENE ESTUARY (MOZAMBIQUE) The Ecology of Morrumbene Estuary, Mozam-	New System Puts the Wood to Wastewater, W76-05586 5D
Flood Routing in Channel Systems with Al-	bique,	MUNICIPAL-INDUSTRIAL WASTES
lowance for Bank Regulation,	W76-06127 2L	Municipal Plant Handles 44% Pulp and Paper
W76-05668 4A	MORTALITY	Mill Wastes,
Coupled Saturated-Unsaturated Transient Flow	Monetary Values of Life and Health.	W76-05778 5D
in Porous Media: Experimental and Numeric	W76-05812 6F	
Model,	MOCOUITORS	MUNICIPAL WASTES
W76-05684 2F	MOSQUITOES Breeding Places and Seasonal Incidence of	Cathodic Inner and Outer Protection for a Dou- ble Syphon for Waste Water (Kathodischer
Madeoulie I and Electrotics in Efficient Tour	Aedes Aegypti, as Assessed by the Single-	Innen-und Aussenschutz Fuer Einen Abwasser-
Hydraulic Load Fluctuation in Effluent Treat- ment Plants (Hydraulicke narazy na sedimen-	Larva Survey Method,	Doppeldueker),
tacni cistirny odpadnich vod),	W76-06033 5G	W76-05584 5D
W76-05699 5D		
	Influences of Some Freshwater Plants on the	Regional Plant Treats Septic Wastes,
Application of Multi-Regional Planning Models	Development and Survival of Mosquito Larvae	W76-05771 5D
to the Scheduling of Large-Scale Water	in British Columbia, W76-06048 5G	Municipal Wastewater Odor Still a Problem
Resource Systems Development, W76-05846 6A	W 70-00046	Part 1,
W76-05846 6A	MOSSES	W76-05773 5D
A Digital-Computer Model for Estimating	The Microenvironment of Climacium Amer-	
Hydrologic Changes in the Aquifer System in	icanum,	Municipal Plant Handles 44% Pulp and Paper
Dane County, Wisconsin,	W76-06045 2G	Mill Wastes,
W76-05851 2F	MOUNT BAKER (WASH)	W76-05778 5D
Finite Element Mesh Gradation for Surface Waves.	Table of Data on Water Quality of Baker Lake near Mount Baker, Washington,	Interim Report on the Impact of Public Law 92- 500 on Municipal Pollution Control Technolo-
W76-05919 8E	W76-05857 7C	gy,
		W76-05867 5D
Hydraulic Computation of a Pool Hollow, W76-05931 2E	MOUNTAIN ROADS Reservoir Sedimentation Associated with	Commonwealth, Department of Natural
MOISTURE DEFICIT	Catchment Attributes, Landslide Potential,	Resources V. Westmoreland-Fayette Municipal
Role of Phenylmercuric Acetate on Stomatal	Geologic Faults, and Soil Characteristics, W76-05617 4D	Sewage Authority (Appeal by Municipal Entity
Regulation and Water Loss in Prosopis	W76-05617 4D	from Order to Curb Discharge of Untreated Sewage into Waters of Pennsylvania.,
Cineraria Linn,	MOUNTAINS	W76-06115 6E
W76-06011 5G	Sublimation or Melting: Observations from the	
MOLYBDENUM	White Mountains, California and Nevada,	MUNICIPAL WATER
The Deposition of Molybdenum in Anoxic	U.S.A.,	Yukon City's New Well Replaces Five Older
Waters,	W76-05683 2C	Ones, W76-05566 4B
W76-05996 2K	MOVEMENT	W 70-03300 4B
Molyhdonum in a Nagratusa and Patronia Po	The Movement of Melting Ice over Rough Sur-	For Which Load Shall Municipal Purification
Molybdenum in a Nearshore and Estuarine En- vironment, North Wales.	faces,	Plants be Dimensioned. (Fuer Welche
W76-06000 2K	W76-05671 2C	Belastung Sollen Kommunale Klaeranlagen Bemessen Werden).
MONITORING	MUD-WATER INTERFACES	W76-05609 5D
A Study of Prospective Water Pollution Con-	Chemistry of Mud-Water Interface in an Im-	
trol Activities for the Ohio River Valley Water	poundment,	MYRIOPHYLLUM-SPICATUM
Sanitation Commission (Orsanco),	W76-05630 5C	Eurasian Water-Milfoil in Michigan,
W76-05654 5G	MULTIOBJECTIVE APPROACH	W76-06149 5G
Design Operation and Manifester of Man	Long Range Planning of Water Resources: A	NATIONAL FLOOD INSURANCE PROGRAM
Design, Operation, and Monitoring of Mu- nicipal Irrigation Systems,	Multi Objective Approach,	Certain Land Use Regulations to Protect from
W76-05783 5E	W76-05760 6A	Danger of Flooding.
	MILI TIBLE OBJECTIVES	W76-06059 6F
Impact of Coal Strip Mining on Water Quality	MULTIPLE OBJECTIVES Multi-Objective Water Resources Planning:	Suggested Provisions to De Head in Zoning On
and Hydrology of East Tennessee,	Multi-Objective Water Resources Planning: Methodology to Achieve Compatibility	Suggested Provisions to Be Used in Zoning Or- dinances for Compliance with Sections
W76-05833 5B	Between Environmental Amenities and	1910.3(C) of the National Flood Insurance Pro-
Utah Definitions and General Requirements.	Economic Development,	gram.
W76-06078 5G	W76-05840 6B	W76-06060 6F

NATIONAL MONUMENTS Legislative Bargain and the Doctrine of Repeal	Nematodes of Lake Balaton: IV. Seasonal Qualitative and Quantitative Changes,	Extraction - Visible Spectrophotometric Method for Determination of Nitrate: Applica-
by Implication (Discussion of Case Involving Colorado River Storage Act).	W76-06004 5C	tion to Water Analysis, W76-05717 5A
W76-06052 4A	NETHERLANDS	AND AND ADDRESS OF THE PARTY OF
WATER AND A LUTION BECOME BOT	Cause and Identification of Taste and Odour	Biological Denitrification and its Application in
NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT Regulations Pertaining to Waste Discharge Per-	Compounds in Water, W76-06009 5A	Treatment of High-Nitrate Waste Water, W76-05792 5D
mits.	NETWORKS	Progress in Methods of Nitrate Removal,
W76-06069 5G	Canadian Water Resources Information: A Network Approach,	W76-05805 5E
NATURAL FLOW	W76-05952 10D	Nitrate Removal from Water by Ion Exchange,
The Hydrologic Potential of Unit Areas: A		W76-05806 5F
Basis for Managing Water Resources, W76-05620 4D	NEUTRALIZATION	NITRIFICATION
W 70-03020	Purification of Gum Rosin Producing Plant Ef- fluents from Resinous Substances (Ochistka	Effects of Salinity on Nitrification in the Eas
NATURAL FLOW DOCTRINE	stochnykh vod kanifol'noterpentinnogo proiz-	River, W76-05631 50
Shaub V. Fifth Judicial District (Adjudication of Water Rights in Main Stream Also an Adju-	vodstva ot smolistykh veshchestv),	W /6-03631
dication of Rights in Tributaries),	W76-05735 5D	Vertical Distribution of Nitrate Concentration
W76-06104 6E	NEUTRON ACTIVATION ANALYSIS	in Interstitial Water of Marine Sediments with
NATURALLY DEVELOPED WELLS	Instrumental Method for the Determination of	Nitrification and Denitrification, W76-05678
Use of Formation Stabilizer - A Valuable	Trace Elements in Water Samples by Neutron	
Technique,	Activation Analysis, W76-05998 5A	Biological Nitrification of Sludge Supernatan
W76-05564 8A	W76-05998 5A	by Rotating Disks, W76-05800 51
NAVIGABLE WATER	NEVADA	W 70-03000
State V Corvallis Sand and Gravel Co.	Factors Influencing Infiltration and Sediment	NITRITES
(Avulsion: Newly Submerged Lands Title in	Production of Semiarid Rangelands in Nevada, W76-05912 2G	Vertical Distribution of Nitrate Concentration in Interstitial Water of Marine Sediments with
Former Owner But Paramount Navigational Servitude in State).	W /6-03912 2G	Nitrification and Denitrification,
W76-06111 6E	NEW ENGLAND RIVER BASINS COMMISSION	W76-05678 51
	How to Guide Growth in Southeastern New	NITROCELLULOSE NITRATE WASTES
NAVIGABLE WATERS Navigable Waters Procedures and Guidelines	England, Parts I, II and IV of the Draft Report. W76-05649 6G	Process for Treating Waste Water Containing
for Disposal of Dredged or Fill Material.	1170-05049	Cellulose Nitrate Particles,
W76-06097 5G	NEW HAMPSHIRE	W76-05575 51
Stream Pollution Control Board of State of In-	Availability of Ground Water in the Androscog-	NITROGEN
diana V. United States Steel Corp. (Common- Law Public Nuisance Action Against Steel	gin River Basin, Northern New Hampshire, W76-05862 7C	Removal of Ammonia Nitrogen by Catalyti Oxidation Filter Bed (Sesshoku sanka rosho r
Corp. in which Private Citizen Sought to Inter-	NEW YORK	yoru ammonia-set chisso no jokyo), W76-05589 51
vene. W76-06106 6E	Hydrogeochemical Data from Investigation of Water Quality in Sewered and Unsewered	W 76-03389
W/0-00100	Areas, Southern Nassau County, Long Island,	Effects of Forest Fertilization on Two
Goose Creek Hunting Club, Inc. V. United	New York,	Southeast Alaska Streams, W76-05612
States (Damages for Government's Taking of Permanent Fiowage Easement).	W76-05858 7C	W 70-03012
W76-06114 6E	In Re: Marine Equities Corp. V. Biggane (Tidal	On the Possibilities of Averaging the Seasons
NAVIGATION	Wetland Act Constitutional as Applied to Ap-	Pattern in Kjeldahl Nitrogen in a Group of Water Bodies,
The Role of Inland Navigation in River Basin	plication for Permit to Fill Under Water Land	W76-06019 51
Development,	Off Staten Island). W76-06100 6E	NAME OF THE OWN POST AND ASSESSED OF THE OWN POST ASSESSED.
W76-05511 4A	,	NITROGEN COMPOUNDS Control of Nitrogen Transformations in Soils,
NAVIGATIONAL SERVITUDE	Stream Bed Stabilization in Enfield Creek,	W76-05608 51
Goose Creek Hunting Club, Inc. V. United	New York, W76-06145 8I	Phosphorus, Nitrogen, and the Growth of
States (Damages for Government's Taking of Permanent Flowage Easement).		Algae in Lake Kinneret,
W76-06114 6E	NEW ZEALAND	W76-05633 50
	Food of Tarakihi in Western Bay of Plenty and Tasman Bay, New Zealand,	NITROGEN FIXATION
NEBRASKA Nebraska Livestock Waste Control Regula-	W76-06047 2L	Algal Nitrogen Fixation in Californian Streams
tions.		Seasonal Cycles,
W76-06079 5G	NITRATE REMOVAL Progress in Methods of Nitrate Removal,	W76-05639 50
NEGLIGENCE	W76-05805 5D	NITROGEN FIXING BACTERIA
Williams V. Duke Power Co. (Silting of Stream,		Effects of Salinity on Nitrification in the East
Ponds, and Lake).	Nitrate Removal from Water by Ion Exchange, W76-05806 5F	River,
W76-06088 6E	W76-05806 5F	W76-05631 50
Lanning V. State Highway Commission (Flood	NITRATES	NON-POINT NUTRIENT SOURCES
Damage by Debris Collected in Front of Bridge	Automated Dilution for Measurement of Nitrate in Water,	Relationships Between Drainage Area Charac
Piers). W76-06113 6E	W76-05594 5A	teristics and Non-Point Source Nutrients i Streams.
		W76-05624 51
NEMATODES The Effect of Oxidized Material on the Vertical	Vertical Distribution of Nitrate Concentration in Interstitial Water of Marine Sediments with	NON-STRUCTURAL ALTERNATIVES

Distribution of Freshwater Benthic Fauna, W76-05743

Nitrification and Denitrification, Suggested Provisions to Be Used in Zoning Ordinances for Compliance with Sections

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NON-STRUCTURAL ALTERNATIVES

1910.3(C) of the National Flood Insurance Pro-	NUCLEATION	Plutonium Concentrations in Water and
gram. W76-06060 6F	Nucleation Characteristics of Stream Water and Frazil Ice Nucleation,	Suspended Sediment from the Miami River Watershed, Ohio,
	W76-05695 2C	W76-05887 5B
NONITERATIVE ALTERNATING DIRECTION IMPLICIT METHOD	NUMERICAL ANALYSIS	Plutonium in Aquatic Biota of the Great Miami
Forecasting Water Levels in Aquifers by Nu-	Normal Mode Analysis of the Linear Equation	River Watershed, Ohio,
merical and Semihybrid Methods,	of Groundwater Flow, W76-05685 2F	W76-05888 5C
W76-05686 2F	W 70-03083	Caldwell V. Goldberg (Discharge of Effluent
NONLINEAR PROGRAMMING	Forecasting Water Levels in Aquifers by Nu-	from Sewage Plant into Drainage Ditch).
Reservoir Management Via Reliability Pro-	merical and Semihybrid Methods, W76-05686 2F	W76-06093 6E
gramming, W76-05508 4A	W 70-03080 2F	OHIO RIVER
W76-05508 4A	Pumping-Test Analysis Using a Discrete Time-	A Study of Prospective Water Pollution Con-
NONOGRAMS	Discrete Space Numerical Method,	trol Activities for the Ohio River Valley Water
Nomograms for Simplified Hydraulic Dimen-	W76-05913 4B	Sanitation Commission (Orsanco), W76-05654 5G
sioning of Waste Water Ducts (Nomogramme	NUTRIENT REMOVAL	W 70-03034
Zur Vereinfachten Hydraulischen Bemessung Von Abwasser-Kanaelen),	Phosphorus Removal from Static Sewage Ef-	OIL
W76-05610 5D	fluent Using Duckweed, W76-05775 5D	Alaska Oil Pollution Regulations. W76-06062 5G
	W 70-03773	W76-06062 5G
NORMAL MODE ANALYSIS	Progress in Methods of Nitrate Removal,	OIL POLLUTION
Normal Mode Analysis of the Linear Equation of Groundwater Flow,	W76-05805 5D	Emulsion Breaking Method,
W76-05685 2F	NUTRIENTS	W76-05527 5G
	The Impact of Timber Harvest, Fertilization,	Removal of Floating Pollutants,
NORTH CAROLINA	and Herbicide Treatment on Streamwater	W76-05533 5G
Vertical Electrical Resistivity Soundings to Locate Ground Water Resources: A Feasibility	Quality in Western Oregon and Washington, W76-05618 5B	Apparatus for the Collection of Buoyant
Study,	W70-05010	Foreign Matter,
W76-05835 4B	Relationships Between Drainage Area Charac-	W76-05534 5G
Salimont Characteristics of Steamer in the	teristics and Non-Point Source Nutrients in Streams.	Watercraft for Scavenging Oil Spillage,
Sediment Characteristics of Streams in the Eastern Piedmont and Western Coastal Plain	W76-05624 5B	W76-05548 5G
Regions of North Carolina,		
W76-05849 2J	The Fate of Nutrients in Back River,	Removal of Immiscible Fluids from Water Sur-
Parismontal Parismontal Programme 1	W76-05625 5C	faces and Lake Beds, W76-05984 5G
Environmental Responses to Thermal Discharges from Marshall Steam Station, Lake	Effect of Environmental Factors on Standing	W 70-03264
Norman, North Carolina,	Crop of Plankton in British Columbia Lakes,	Alaska Oil Pollution Regulations.
W76-05870 5C	W76-05741 5C	W76-06062 5G
Certain Land Use Regulations to Protect from	OAK TREE	Regulations Pertaining to Oil Spills into Public
Danger of Flooding.	Emory Oak (Quercus Emoryi) Litter Phenolics	Waters.
W76-06059 6F	as Environmental Hazards for Aquatic Animals in Southeastern Arizona,	W76-06071 5G
WWW W. D. L. D. G. (67).	W76-06125 5B	OIL SPILL CLEAN-UP
Williams V. Duke Power Co. (Silting of Stream, Ponds, and Lake).		Regulations Pertaining to Oil Spills into Public
W76-06088 6E	OBSERVATION WELLS	Waters. W76-06071 5G
	Portable Water Sampling Apparatus, W76-05958 7B	W76-06071 5G
NORTH DAKOTA		OIL SPILLS
Spatial Variability of in Situ Unsaturated Hydraulic Conductivity of Maddock Sandy	OCEAN CURRENTS	Removal of Floating Pollutants,
Loam,	Wave-Action Power Apparatus, W76-05549 8C	W76-05533 5G
W76-05670 2G		Apparatus for the Collection of Buoyant
NORMANN ORDINAL INC	OCEAN WAVES	Foreign Matter,
NORTHERN GREAT PLAINS Northern Great Plains Resource Program.	Wave-Action Power Apparatus, W76-05549 8C	W76-05534 5G
W76-06050 6D	W 70-03349	Watercraft for Scavenging Oil Spillage,
	OCEANS	W76-05548 5G
NORWAY	The Economics of Alternative Deep Seabed	Removal of Immiscible Fluids from Water Sur-
Macrovegetation and Ecological Factors in Two Norwegian Lakes,	Regimes, W76-05816 6E	faces and Lake Beds,
W76-06044 5C		W76-05984 5G
	ODOR	Regulations Pertaining to Oil Spills into Public
NUCLEAR POWERPLANTS	Supernatant Doesn't Have to Ruin Effluent Quality,	Waters.
Comparison of the Movement and Recapture of Salmonid Fishes Tagged at Two Power Plants,	W76-05772 5D	W76-06071 5G
W76-05894 5C	Municipal Wastewater Odor Still a Problem	OIL WASTES
	Part 1,	Port Collection and Separation Facilities for
NUCLEAR STUDIES The Distribution of Plutonium in Lake	W76-05773 5D	Oily Wastes. Vol. 5. A Comparative Analysis of
Michigan Sediments,	Cause and Identification of Tools and Odana	Conceptual System Plans for the Surveyed
W76-05892 5B	Cause and Identification of Taste and Odour Compounds in Water.	Ports Under the 'No Discharge', '1969 Amend- ments' and 'No Sheen' Criteria,
	W76-06009 5A	W76-05830 5D
NUCLEAR TECHNIQUES Nuclear Techniques in HydrologyCurrent	оню	Becausing Ditumen for I W
Status and Prospective Uses.	Miami River Watershed Project: Introduction,	Recovering Bitumen from Large Water Sur- faces,
W76-05922 5A	W76-05886 5B	W76-05992 5G

and iver 5B iami 5C uent 6E

Con-5G

5G

5G 5G yant 5G 5G Sur-5G 5G ublic

ublic 5G

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5D Sur-

5G

OILY WATER	OPTICAL PROPERTIES	Oliver V. Hyle (Termination of Water and
Emulsion Breaking Method,	A Spectral Light Absorption Meter for Mea-	Sewer Services for Failure to Pay Arrearages
W76-05527 5G	surements in the Sea,	Denial of Due Process).
Process for Separating Oil from Emulsions of	W76-05680 7B	W76-06094 6E
Oil in Water,	OPERATO A MACONI	Water Quality Standards: Oregon (Withdrawal
W76-05964 5D	OPTIMIZATION	Water Quality Standards: Oregon (Withdrawal of Proposed Rule Making).
W 70-03504 3D	Uncertainty in Water Resources Decision Mak-	W76-06098 5G
OKLAHOMA	ing,	W 70-00096
Dependable Yield of Reservoirs with Intermit-	W76-05513 6A	State V Corvallis Sand and Gravel Co.
tent Inflows,	Optimal Design Model for Waste Water Collec-	(Avulsion: Newly Submerged Lands Title in
W76-05908 4A	tion System (II) (Gesuidokan kiyo keikaiu no	Former Owner But Paramount Navigational
	saitekika moderu to sono oyo (II)),	Servitude in State).
Story V. Hefner (Deeds Purporting to Divide	W76-05598 5D	W76-06111 6E
Lake in Half Ineffective to Prohibit Use of En-	W 70-03398	
tire Surface for Recreational Purposes).	Optimizing Organic Carbon and Color Removal	Lanning V. State Highway Commission (Flood
W76-06102 6E	from a Board Mill Effluent,	Damage by Debris Collected in Front of Bridge
OLICOCH A PERC	W76-05724 5D	Piers).
OLIGOCHAETES	35	W76-06113 6E
The Effect of Oxidized Material on the Vertical	An Economic Analysis of Water Use in	ORGANIC ACIDS
Distribution of Freshwater Benthic Fauna,	Colorado's Economy,	
W76-05743 5C	W76-05837 6B	Ion Exchange Technique for the Determination
CLIGOTROPHY		of Chlorinated Phenols and Phenoxy Acids in
Evaluation of the Trophic Types of Several	OREGON	Organic Tissue, Soil, and Water,
Alaskan Lakes by Assessment of the Benthic	Impact of Clear-Cutting and Road Construction	W76-06122 5A
Fauna,	on Soil Erosion by Landslides in the Western	ORGANIC COMPOUNDS
W76-05604 5C	Cascade Range, Oregon,	Sewage Treatment,
11.0.0004	W76-05614 4C	W76-05582 5D
OLYMPIC NATIONAL FOREST (WASH)		W 70-03302
Effects of Forest Fertilization with Urea on	The Impact of Timber Harvest, Fertilization,	ORGANIC MATTER
Stream Water QualityQuilcene Ranger Dis-	and Herbicide Treatment on Streamwater	Some Relations Between Forest Litter and
trict, Washington,	Quality in Western Oregon and Washington,	Growth of Sitka Spruce on Poorly Drained
W76-05938 5B	W76-05618 5B	Soils,
		W76-05687 21
ON-SITE DATA COLLECTIONS	Efficiency in Water Quality Control for the	
Careful Sample Taking is Key to Successful	Willamette River,	The Effect of Thermal Discharge on the Rate
Wells,	W76-05658 5G	of Accumulation of Organic Substances on
W76-05560 4B		Glass Surfaces Immersed in Lake Norman,
	Late Pleistocene and Holocene Depositional	W76-05875 5C
ON-SITE INVESTIGATIONS	Trends, Processes, and History of Astoria	
Spatial Variability of in Situ Unsaturated	Deep-Sea Fan, Northeast Pacific,	Demand for Dissolved Oxygen Exerted by
Hydraulic Conductivity of Maddock Sandy	W76-05845 2L	Finely Divided Logging Debris in Streams,
Loam,		W76-05939 4C
W76-05670 2G	Geology and Geomorphology of the H. J. An-	ORGANIC POLYMERS
	drews Experimental Forest, Western Cascades,	Air Rotary Drilling with Organic Polymers Of-
ONTARIO (CANADA)	Oregon,	fers Many Benefits,
Development of Oxygen Deficits in 14	W76-05941 4D	W76-05562 8B
Southern Ontario Lakes,	Tinks Butselin and Water Coulin	W 70-03302
W76-05679 5C	Timber Production and Water Quality	ORGANIC WASTES
OPEN CHANNELS	Progress in Planning for the Bull Run, Portland,	Chemical Characterization of Industrial Waste-
Flowmeter for an Open Aqueduct,	Oregon's Municipal Watershed,	waters by Gas Chromatography-Mass Spec-
	W76-05942 5B	trometry,
W76-05540 7B	Pood Standards on Steam Torrain in the Posific	W76-06008 5A
OPERATING COSTS	Road Standards on Steep Terrain in the Pacific	
Minimizing the Operating and Capital Costs of	Northwest U.S.A. with Suggestions for Imple-	Evaluation of Surface Water Pollution at
Water Supply Projects,	mentation,	Several Points in Relation to Zones of Shellfish
W76-05522 6A	W76-05948 4C	Industry in Roadsteads of the Brest Region, (In
0A	The Taking Issue: Potential Obstacle to natural	French),
Efficient Wells Save Energy and Reduce Costs,	Resource Management Legislation,	W76-06150 5B
W76-05563 4B		
	W76-06055 6E	ORSANCO (OHIO RIVER VALLEY WATER
Low Cost Phosphorous Removal,	Regulations Pertaining to Waste Discharge Per-	SANITATION COMMISSION)
W76-05786 5D	mits.	A Study of Prospective Water Pollution Con-
	W76-06069 5G	trol Activities for the Ohio River Valley Water
Converting Sewage into Savings.		Sanitation Commission (Orsanco),
W76-05790 5D	Deposit of Motor Vehicle Bodies and Accesso-	W76-05654 5G
Minimal Coat Blant Clausia W. W. A	ries into the Waters of the State.	OSCILLATORIA
Minimal Cost Plant Cleaning Up Harbor,	W76-06070 5G	OSCILLATORIA Statistical Study of the Duckwood Phisosphere
W76-05796 5D		Statistical Study of the Duckweed Rhizosphere
Lime Use in Wastewater Treatment: Design	Regulations Pertaining to Oil Spills into Public	as an Eco-Assay Tool,
and Cost Data,	Waters.	W76-05605 5B
W76-05868 5D	W76-06071 5G	OUT-OF-KILTER ALGORITHM
11 / U-U3000 3D	30	The Out-Of-Kilter Algorithm and Some of its
OPERATIONS	Confined Animal Feeding or Holding Opera-	Applications in Water Resources.
Records and Drilling Reports.	tions.	W76-05515 6A
W76-05557 6A	W76-06072 5G	
00007		OUTFALLS
Design, Operation, and Monitoring of Mu-	State Financial Assistance to Public Agencies	Edinburgh's Sewage-Treatment and Disposal
nicipal Irrigation Systems,	for Pollution Control Facilities.	Scheme,
W76-05783 5E	W76-06073 5G	W76-05794 5D

5D

OWNERSHIP OF BEDS

OWNERSHIP OF BEDS State V. Griffith (Private Claim to Tidelands).	Proper Selection of Gravel Pack is Key to Suc- cessful Wells,	Filtering Apparatus and Process, W76-05546 5D
W76-06087 6E	W76-05565 8C	
		Water Treating Apparatus,
State V Corvallis Sand and Gravel Co. (Avulsion: Newly Submerged Lands Title in	PATENTS Underwater Wall Structure,	W76-05547 5F
Former Owner But Paramount Navigational	W76-05523 8A	Watercraft for Scavenging Oil Spillage,
Servitude in State).		W76-05548 5G
W76-06111 6E	Method of Biological Purification of Sewage,	Wave-Action Power Apparatus,
OXIDATION	W76-05524 5D	W76-05549 8C
Wastewater Treatment,	Biodegradation of Methanolic Waste Water,	Process for Treating Waste Water Containing
W76-05579 5D	W76-05525 5D	Cellulose Nitrate Particles,
OXIDATION LAGOONS	Buffered, Weak Ion-Exchange Water	W76-05575 5D
Pond and Irrigation Systems Offer Economy	Demineralization Process,	W
and Flexibility,	W76-05526 3A	Water Clarification Settler. W76-05578 5F
W76-05774 5D	Emulsion Breaking Method,	
OXIDATION-REDUCTION	W76-05527 5G	Wastewater Treatment,
Examination and Removal of Iron in Ground-		W76-05579 5D
water,	Liquid Purifying Process, W76-05528 5D	Waste Water and Sewage Treatment.
W76-05571 5B	W 76-03328	W76-05580 5D
OXYGEN DEMAND	Inhibition of Scale Deposition,	Submerged Air Release Device Particularly for
Development of Oxygen Deficits in 14	W76-05529 5D	Sewage Treatment,
Southern Outario Lakes,	Pollution Control System for Water Supply,	W76-05581 5D
W76-05679 5C	W76-05530 5F	Samuel Transfer and
A Coulometric Device for Measuring Total Ox-		Sewage Treatment, W76-05582 5D
ygen Demand,	Synergistic Compositions Containing 2,2- Dibromo-3-Nitrilopropionamide and 3,3,4,4-	
W76-05728 5A	Tetrachlorotetrahydro-Thiopene-1,1-Dioxide	Water Purified by Electroflotation for Rapid
OXYGEN SAG	and Their Use,	Sedimentation and Clean Clarified Water. W76-05766 5D
Steady-State Segmented Dissolved-Oxygen	W76-05531 5F	W /6-03/66 3D
Model,	Detection Devices for Use in Solution	Flotation Process and Apparatus.
W76-05855 5B	Detection Devices for Use in Solution Processing Systems,	W76-05767 5D
OXYGEN TRANSFER	W76-05532 5F	Process and Equipment for Automatic Chemi-
Aerated Lagoons Solve Town's Site Problems,		cal-Biological Wastewater Treatment with
W76-05799 5D	Removal of Floating Pollutants, W76-05533 5G	Provisions for Recycle and Reuse,
OXYGEN TRANSFER RATES	W 76-03333	W76-05955 5D
How Does Tank Geometry Affect the Oxygen	Apparatus for the Collection of Buoyant	Impact Sprinkler,
Transfer Rate of Mechanical Surface Aerators.	Foreign Matter,	W76-05956 3F
W76-05593 5D	W76-05534 5G	Polonical Controller Version & Polonic
OXYGENATION	Bio Pond Acrator,	Balanced Sprinkler Impact Drive, W76-05957 3F
Methods and Apparatus for Treating Waste-	W76-05535 5D	
water,	Leaching Polyelectrolyte Fluidized Solids,	Portable Water Sampling Apparatus,
W76-05987 5D	W76-05536 5D	W76-05958 7B
OYSTERS	W	Desalination Apparatus,
Epizootiology of Minchinia Nelsoni in	Water Current Power Generator System, W76-05537 8C	W76-05959 3A
Susceptible Wild Oysters in Virginia, 1959 To	1170-03337	Evaporator-Condenser Unit for Producing
1971, W76-06035 5C	Apparatus and Method for Extracting Wave	Potable Water From Sewage,
W 70-00033	Energy,	W76-05960 5D
PACIFIC OCEAN	W76-05538 8C	Wastewater Treatment,
Late Pleistocene and Holocene Depositional Trends, Processes, and History of Astoria	Line Motion and Water Current Disc Sensor,	W76-05961 5D
Deep-Sea Fan, Northeast Pacific,	W76-05539 7B	
W76-05845 2L	Flowmeter for an Open Aqueduct,	Ion Exchanger for the Treatment of Waste Water,
BARTORAN	W76-05540 7B	W76-05962 5D
PAKISTAN Ex-Post Evaluation of River Basin Develop-	Water Line,	
ments in Pakistan,	W76-05541 3F	Method of Treating Waste Liquids from Photo- graphic Processings,
W76-05748 6A		W76-05963 5D
PAKISTAN (KINJHAR LAKE)	Process for Biochemical Reactions,	
Seasonal Distribution of Phytoplankton in Kini-	W76-05542 5D	Process for Separating Oil from Emulsions of Oil in Water.
har (Kalri) Lake,	Method and Apparatus for Centrifugally	W76-05964 5D
W76-06146 5C	Separating Finely Divided Solids from Aqueous	
PARAMETRIC HYDROLOGY	Suspensions Thereof, W76-05543 5D	Method of Reducing Sludge Accumulation from Tar Sands Hot Water Process,
Using Parametric Models of Runoff to Improve		W76-05965 5D
Parameter Estimates for Stochastic Models,	Use of Polymeric Quaternary Ammonium	
W76-05911 2E	Betaines as Water Clarifiers, W76-05544 5F	Method of Extracting Heavy Metals from In-
PARTICLE SIZE	W76-05544 5F	dustrial Waste Waters, W76-05966 5D
Colorado City Solves its Sand Pumping	Process for Conditioning Effluent Con-	
Problems, W76-05559 8C	taminated by Aldehyde Compounds, W76-05545 5D	Apparatus for the Treatment of Liquid Wastes,
	W76-05545 5D	W76-05967 5D

5D
5F
5G
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aining
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Water Purification Apparatus and Timing Device for Initiating A Backwashing Cycle,	Apparatus for the Separation of Liquid Mix- tures My Means of Permeability Selective	PERMIABILITY Proper Selection of Gravel Pack is Key to Suc-
W76-05968 5F	Separation Membranes, W76-05991 3A	cessful Wells, W76-05565 8C
Sewage Treatment System, W76-05969 5D	Recovering Bitumen from Large Water Sur-	PERMIT
110-03203	faces.	South Dakota Water Pollution Law.
Apparatus for Collecting Surface Particle on Body of Water,	W76-05992 5G	W76-06074 5G
W76-05970 5G	PATH OF POLLUTANTS	PERMITS
Method of Preventing Scale From Being	Trace Element, Mineralogy, and Size Distribu- tion of Suspended Material Samples from	The Washington Shoreline Management Act, W76-06056 5G
Deposited In Case of Producing Fresh Water From Sea Water,	Selected Rivers in Eastern Kansas,	Corps Issues Interim Rules for Discharges of
W76-05971 3A	W76-05606 5B	Dredged and Fill Materials.
	Nutrient Cycling in 37- and 450-Year-Old	W76-06061 5G
Method for the Primary and Secondary Treat-	Douglas-Fir Ecosystems,	Alaska Oli Dallasian Baradasian
ment of Wastewater in a Unitary Apparatus, W76-05972 5D	W76-05619 5B	Alaska Oil Pollution Regulations. W76-06062 5G
Process for the Treatment of Mineral Slimes,	A Stochastic Model of Dispersion of Sediment	Certification of Conformance with Water
W76-05973 5D	Particles Released from A Continuous Source, W76-05663 2J	Quality Standards. W76-06066 5G
Filter Cleaning Method,		
W76-05974 5F	Vertical Distribution of Nitrate Concentration in Interstitial Water of Marine Sediments with	Michigan Water Resources Commission Act. W76-06068 5G
Multi-Tank Ion Exchange Water Treatment	Nitrification and Denitrification,	Regulations Pertaining to Waste Discharge Per-
System,	W76-05678 5B	mits.
W76-05975 5F	Movement of Tracers Through Soil,	W76-06069 5G
Dissolved Air Floatation System,	W76-05701 5B	
W76-05976 5D	36	Deposit of Motor Vehicle Bodies and Accesso-
	Impact of Coal Strip Mining on Water Quality	ries into the Waters of the State. W76-06070 5G
Water Level Gauge,	and Hydrology of East Tennessee,	11 / 3-000/0
W76-05977 7B	W76-05833 5B	Confined Animal Feeding or Holding Opera-
Multistage Flash Evaporator for Producing Soft	Modeling the Effect of Waste Discharges in a	tions.
Water from a Saline Water,	Small Mountain Stream,	W76-06072 5G
W76-05978 3A	W76-05834 5B	Utah Water Pollution Control Act.
Method and Apparatus for Desalinization of		W76-06077 5G
Water,	Steady-State Segmented Dissolved-Oxygen	Litab Definitions and General Pagniroments
W76-05979 3A	Model, W76-05855 5B	Utah Definitions and General Requirements. W76-06078 5G
Desalination Process by Improved Multistage	Miami River Watershed Project: Introduction,	In Re: Marine Equities Corp. V. Biggane (Tida
Electrodialysis, W76-05980 3A	W76-05886 5B	Wetland Act Constitutional as Applied to Ap- plication for Permit to Fill Under Water Land
Method and Apparatus for the Anaerobic	Solute Travel-Time Estimates for Tile-Drained	Off Staten Island).
Digestion of Decomposable Organic Materials,	Fields: I. Theory,	W76-06100 6E
W76-05981 5D	W76-05904 5B	PERMSELECTIVE MEMBRANES
	Solute Travel-Time Estimate for Tile-Drained	Desalination Process by Improved Multistage
Purification of Waste Water Containing Phthal-	Fields: II. Application to Experimental Studies,	Electrodialysis,
ic Esters, W76-05982 5D	W76-05905 5B	W76-05980 3A
30		Apparatus for the Separation of Liquid Mix-
Method of Operating Ion Exchange System,	PEAK AMPLITUDE	tures My Means of Permeability Selective
W76-05983 5F	Conditional Expected Tsunami Inundation for Hawaii.	Separation Membranes,
Removal of Immiscible Fluids from Water Sur-	W76-05920 8B	W76-05991 3A
faces and Lake Beds,	6B	PESTICIDE RESIDUES
W76-05984 5G	PENNSYLVANIA	Accumulation and Elimination of Dieldrin by
Mathed of Treatment of Chiles With City	Limnological Data for the Major Streams in	Channel Catfish (Intalurus Punctatus),
Method of Treatment of Sludges With Size-Ad- justed Carbon,	Chester County, Pennsylvania, W76-05852 7C	W76-05642 50
W76-05985 5D	Selfered Characteristics of Fig. Co.	Pesticide Residue Dynamics in a Fores
Method for Removing Soluble Selenium from	Sediment Characteristics of Five Streams Near	Ecosystem: A Compartment Model, W76-05946 5E
Acidic Waste Water,	Harrisburg, Pennsylvania, Before Highway Construction,	
W76-05986 5D	W76-05854 4C	Mirex Residues in Selected Estuaries of South Carolina: June 1972,
Methods and Apparatus for Treating Waste-	Commonwealth, Department of Natural	W76-05954 5A
water,	Resources V. Westmoreland-Fayette Municipal	PHENOLS
W76-05987 5D	Sewage Authority (Appeal by Municipal Entity from Order to Curb Discharge of Untreated	Ion Exchange Technique for the Determination
Sewage Treatment and Recycling System, W76-05988 5D	Sewage into Waters of Pennsylvania.,	of Chlorinated Phenols and Phenoxy Acids in Organic Tissue, Soil, and Water,
W76-05988 5D	W76-06115 6E	W76-06122 5A
Flocculation Apparatus,	BERM A EDOCT	
W76-05989 5F	PERMAFROST Exploitation of the Waters of Subpermafrost	Emory Oak (Quercus Emoryi) Litter Phenolics
Reverse Osmosis Separation Apparatus,	Artesian Basins,	as Environmental Hazards for Aquatic Animals in Southeastern Arizona,
W76-05990 3A	W76-05930 3B	W76-06125 5E

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PHENYLMERCURIC ACETATE

PHENYLMERCURIC ACETATE Role of Phenylmercuric Acetate on Stomatal Regulation and Water Loss in Prosopis Cineraria Linn.	PHYSIOLOGICAL ECOLOGY Developments in Underwater Radiotelemetry and Preliminary Fish Tracking in Thermal Plumes.	A Study of Prospective Water Pollution Control Activities for the Ohio River Valley Water Sanitation Commission (Orsanco), W76-05654
W76-06011 5G	W76-05893 5C	A Rural Mississippi Success Story: Alcorn
PHOSPHATES Detergent Phosphate Ban Yields Little	PHYTOPHTHORA-SPP Occurrence of Phytophthora Species and Other	County's Water System. W76-05657 6D
Phosphorus Reduction, Part I, W76-05637 5C	Potential Plant Pathogens in Recycled Irrigation Water,	Technical-Economic Planning of the Gab-
Nature and Stability of Complex Mercury	W76-06010 5C	cikovo-Nagymaros Barrage Project for the Development of the Central-Danube Basin, W76-05754
Compounds in Surface and Ground Waters, Phase II, W76-05838 5A	PHYTOPLANKTON The Application of Sequential Estimation Methods to Counts of Phytoplankton.	Simulation as a Tool in International River
Water and Phosphate Transport to Plant Roots,	W76-05622 5A	Development, W76-05757 6A
W76-06002 21 Behaviour of Some Phosphatic Fertilizers in	Brackish-Water Phytoplankton Response to Temperature Elevation, W76-05999 5C	Evaluation of Quality Parameters in Water Resource Planning: A State-of-the-Art Survey of the Economics of Water Quality,
Water, W76-06139 5B	A Note on the Use of Algal Sizes in Estimates	W76-05818 5G
PHOSPHORUS COMPOUNDS	of Population Standing Crops, W76-06043 5A	Multi-Objective Water Resources Planning:
Phosphorus, Nitrogen, and the Growth of	W76-06043 5A	Methodology to Achieve Compatibility
Algae in Lake Kinneret,	PIEDMONT REGION (NC)	Between Environmental Amenities and
W76-05633 5C	Sediment Characteristics of Streams in the Eastern Piedmont and Western Coastal Plain	Economic Development, W76-05840 6B
PHOSPHORUS LOAD	Regions of North Carolina,	Timber Production and Water Quality
A Description of the Trophic Status and Nutrient Loading for Lake George, New York,	W76-05849 2J PIERS	Progress in Planning for the Bull Run, Portland, Oregon's Municipal Watershed,
W76-05638 5C	Lanning V. State Highway Commission (Flood	W76-05942 5B
PHOSPHORUS REMOVAL	Damage by Debris Collected in Front of Bridge	Social Assessment Manual: A Guide to the
Phosphorus Removal from Static Sewage Ef-	Piers).	Preparation of the Social Well Being Account,
fluent Using Duckweed,	W76-06113 6E	W76-05993 6B
W76-05775 5D		
Low Cost Phosphorous Removal,	PILOT PLANTS	Evaluation of Economic Benefits for Flood
W76-05786 5D	Combined Waste Treatment Proves Economical and Feasible,	Control and Water Resource Planning. W76-06083 4A
PHOSTRIP PROCESS	W76-05787 5D	PLANT GROWTH
Low Cost Phosphorous Removal, W76-05786 5D	PIPE FLOW Sewer Flow Measurement - A State-Of-The-Art Assessment,	Water and Phosphate Transport to Plant Roots, W76-06002 21
PHOTOGRAPHIC PROCESSING WASTES Method of Treating Waste Liquids from Photo-	W76-05865 5D	PLANT MORPHOLOGY Factors Influencing Infiltration and Sediment
graphic Processings, W76-05963 5D	PIPES Nomograms for Simplified Hydraulic Dimen-	Production of Semiarid Rangelands in Nevada, W76-05912 2G
PHOTOGRAPHY	sioning of Waste Water Ducts (Nomogramme	PLANT PHYSIOLOGY
Estimating Dry Weight of Live, Unanesthetized Fish by Photography,	Zur Vereinfachten Hydraulischen Bemessung Von Abwasser-Kanaelen),	Eco-Physiological Studies on Desert Plants: IX. Types of Transpiration Curves of Zilla Spinosa
W76-05615 5A	W76-05610 5D	Prantl Under Natural Conditions, W76-06123 2D
Silver in Photoprocessing Effluents,	PLANKTON Observations on the Seasonal Fluctuations of	
W76-05732 5D	Plankton in the Chilka Lake, W76-06118 2H	Plant Development Under Snow, W76-06147 21
Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the	PLANNING	PLANTING MANAGEMENT Effect of Different Methods of Planting in Pud-
Results of Moving and Still Particle Photog-	Environmental Considerations in River Basin	dled Soil on the Yield of Rice,
raphy, W76-05932 8B	Planning and Decision Making, W76-05510 4A	W76-06017 3F
PHOTOMETRY	Recent Trends in Water Quality Management	PLASTIC PIPES
Determination of Selenium in Natural Waters Using the Centrifugal Photometric Analyzer,	and Protection in Hungary, W76-05518 5G	PVC Pipe in Water Distribution: Reliability and Durability,
W76-06128 2K		W76-05552
PHOTOSYNTHESIS	Water Resources Development in the Tisza River Basin and Its Impact on Socio-Economic	Plastic Pipe, Pressure Sewers, Mark Expansion,
Primary Production,	Growth,	W76-05765 5D
W76-05874 5C	W76-05519 4A	PLASTICS
PHTHALIC ESTERS Purification of Waste Water Containing Phthal-	How to Guide Growth in Southeastern New England, Parts I, II and IV of the Draft Report.	Overwintering of Evergreens in Plastic Struc- tures,
ic Esters,	W76-05649 6G	W76-06014 2
W76-05982 5D	Standards Committee to	
PHYSICAL PROPERTIES	Structuring Communications Programs for Public Participation in Water Resources	Plastics and Synthetics Point Source Category
Brittle Fracture of Ice at 77 K,	Planning,	(Proposed Effluent Limitations and Guidelines).
W76-05673 2C	W76-05652 6B	W76-06086 50

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PLATE RIVER BASIN (SOUTH AMERICA)	Rapid Photochemical Decomposition of Or-	Measuring and Minimizing the Social Cost of
International Management of the River Plate	ganic Mercury Compounds in Natural Water, W76-05715	Environmental Pollution, W76-05824 5G
Basin, W76-05756 4A	W76-05715 5A	W76-05824 5G
	Removal of Copper and Iron Prior to Water	Port Collection and Separation Facilities for
PLUME RESIDENCE	Hardness Titration,	Oily Wastes. Vol. 5. A Comparative Analysis of
Effect of Plume Residence on the Accumula-	W76-05716 SA	Conceptual System Plans for the Surveyed
tion of Cs137 by Lake Michigan Salmonids, W76-05902 5C	Extraction - Visible Spectrophotometric	Ports Under the 'No Discharge', '1969 Amend-
W 70-03902	Method for Determination of Nitrate: Applica-	ments' and 'No Sheen' Criteria, W76-05830 5D
PLUTONIUM	tion to Water Analysis.	W76-05830 5D
Radiological and Environmental Research Divi-	W76-05717 5A	POLYELECTROLYTES
sion Annual Report - Ecology, January-		Leaching Polyelectrolyte Fluidized Solids,
December 1974.	Chemical Characterization of Fiber Building	W76-05536 5D
W76-05879 5C	Board Mill Effluent,	
Mismi Biver Wetershad Brainsty Introduction	W76-05731 5A	Comparative Toxicity of Polyelectrolytes to
Miami River Watershed Project: Introduction, W76-05886 5B	An Automated Technique for the Sub-Micro-	Selected Aquatic Animals,
W /0-03880	gram Determination of Selenium and Arsenic in	W76-05740 5C
Plutonium Concentrations in Water and	Surface Waters by Atomic Absorption Spec-	POLYETHYLENE PIPES
Suspended Sediment from the Miami River	troscopy.	Plastic Pipe, Pressure Sewers, Mark Expan-
Watershed, Ohio,	W76-05736 5A	sion,
W76-05887 5B		W76-05765 5D
	Nature and Stability of Complex Mercury	W 10-03-103
Plutonium in Aquatic Biota of the Great Miami	Compounds in Surface and Ground Waters,	POLYHALINE COASTAL LAKES
River Watershed, Ohio,	Phase II,	Changes in the Limnological Features of a
W76-05888 5C	W76-05838 5A	Meromictic Lake Suigetsu During the Years,
The Chemical Speciation of PU-239, PU-240	Complete AM de La Complete Management	1926-1967,
and CS-137 in Lake Michigan Waters,	Compilation of Methodology used for Measur-	W76-06018 2H
W76-05889 5B	ing Pollution Parameters of Sanitary Landfill	
W 10-03003	Leachate, W76-05869 5A	POLYMERS
Effect of Municipal Treatment Processes on	W76-05869 5A	Air Rotary Drilling with Organic Polymers Of-
PU-239, PU-240, and CS-137,	Mirex Residues in Selected Estuaries of South	fers Many Benefits,
W76-05890 5F	Carolina: June 1972,	W76-05562 8B
	W76-05954 5A	MANING
Sedimentary Pu-239, Pu-240 Phase Distribu-	1170 00707	PONDS
tions in Lake Michigan Sediments,	Chemical Characterization of Industrial Waste-	On the Possibilities of Averaging the Seasonal
W76-05891 5B	waters by Gas Chromatography-Mass Spec-	Pattern in Kjeldahl Nitrogen in a Group of
The Distribution of Plutonium in Lake	trometry,	Water Bodies,
	W76-06008 5A	W76-06019 5B
Michigan Sediments, W76-05892 5B		Seasonal Variation in Dissolved Carbohydrate
W76-05892 5B	Cause and Identification of Taste and Odour	(DCHO) Content in Three Freshwater Ponds,
POLAR ICE SHEETS	Compounds in Water,	W76-06117 2H
Internal Reflections in Polar Ice Sheets,	W76-06009 5A	W 10-00117
W76-05681 2C	Occurrence of Physicalthern Species and Other	POOL HOLLOWS
	Occurrence of Phytophthora Species and Other	Hydraulic Computation of a Pool Hollow,
POLAR REGIONS	Potential Plant Pathogens in Recycled Irrigation Water,	W76-05931 2E
Internal Reflections in Polar Ice Sheets,	W76-06010 5C	
W76-05681 2C	W 70-00010	POROUS MEDIA
BOLLUTANT IDENTIFICATION	Ion Exchange Technique for the Determination	Coupled Saturated-Unsaturated Transient Flow
POLLUTANT IDENTIFICATION Ouality and Variation of Pollutant Loads in	of Chlorinated Phenols and Phenoxy Acids in	in Porous Media: Experimental and Numeric
	Organic Tissue, Soil, and Water,	Model,
Urban Stormwater Runoff, W76-05576 5B	W76-06122 5A	W76-05684 2F
W/0-033/0		PORTFOLIO APPROACH
Automated Dilution for Measurement of	Mercury in Sediments of the Horwer Bucht	A Portfolio Approach to Public Water Project
Nitrate in Water,	(Lake Lucerne) and Tributary Streams, Swit-	Decision Making,
W76-05594 5A	zerland,	W76-05995 6B
	W76-06136 5A	W 10-03333
Stream Analyzers are for Waste as Well as	Mercury Occurrence in Sediment Cores from	POST-IMPOUNDMENT
Product,	Western Lake Erie,	Ex-Post Evaluation of River Basin Develop-
W76-05596 5A	W76-06137 5B	ments in Pakistan,
Estimating Dry Weight of Live,		W76-05748 6A
Unanesthetized Fish by Photography,	POLLUTANTS	
W76-05615 5A	Detailed Economic Models for Industrial and	POTABLE WATER
	Other Activities,	The Safe Drinking Water Act of 1974: A
Nutrient Cycling in 37- and 450-Year-Old	W76-05817 5G	Management Impact Statement.
Douglas-Fir Ecosystems,	BOLLUTION ABATEMENT	W76-05656 5G
W76-05619 5B	POLLUTION ABATEMENT	POULTRY WASTES
Boold Determination of the Cod of Ettleson	Emulsion Breaking Method,	Environmental Protection Agency-Poultry
Rapid Determination of the Cod of Effluents	W76-05527 5G	Processing Products, Proposed Performance
(Uskorennoe opredelenie KhPK stochnykh vod),	Watercraft for Scavenging Oil Spillage,	and Pretreatment Standards.
W76-05705 5A	W76-05548 5G	W76-06096 5G
Analysis of Pulp and Paper Mill Waste Waters	Management of Environmental Quality: Obser-	POWERPLANTS
by High-Resolution Ion-Exchange Chromatog-	vations on Recent Experience in the United	Temperature Optimum of Algae Living in the
raphy,	States and the United Kingdom,	Outfall of a Power Plant on Lake Monona,
W76-05709 5A	W76-05659 5G	W76-06001 5C

PRECIPITATION (ATMOSPHERIC)

PRECIPITATION (ATMOSPHERIC)		
PRECIPITATION (ATMOSPHERIC)	PRODUCTIVITY	The Columbia Basin Project Reappraised,
Precipitation Management for Reclamation of	Productivity and Biochemical Composition of	W76-05750 4A
Overgrazed Areas in Arid and Semi-Arid Re-	Chlorella at Different Levels of Illumination	Inter Basin Transfer of Water Resource Case
gions,	and Nitrogen Limitation, W76-05640 5C	Study of Indus Project,
W76-05603 2B	W 70-03040 SC	W76-05753 4A
The Hydrologic Potential of Unit Areas: A	Effect of Environmental Factors on Standing	
Basis for Managing Water Resources,	Crop of Plankton in British Columbia Lakes,	A Portfolio Approach to Public Water Project
W76-05620 4D	W76-05741 5C	Decision Making,
	The Effect of Thomas Discharge on the Bota	W76-05995 6B
Allowance for Precipitation and Runoff Fluc-	The Effect of Thermal Discharge on the Rate of Accumulation of Organic Substances on	PROSOPIS-CINERARIA
tuation Patterns in Computing Water	Glass Surfaces Immersed in Lake Norman,	Role of Phenylmercuric Acetate on Stomatal
Withdrawal for Irrigation Systems in the	W76-05875 5C	Regulation and Water Loss in Prosopis
Southern Ukraine,		Cineraria Linn,
W76-05675 4A	Notes on the Production of Stream Bryophytes	W76-06011 5G
Possibility of Determining the Areas of Heavy	in the High Pyrenees (France),	PROTOZOA
Precipitation by Discrete Representation of	W76-06129 2I	Factors in the Furification of Flowing Sewage
Radar Data,	Seasonal Dynamics and Productivity of Tany-	and Activated Sludge Process, Part I,
W76-05933 2B	tarsus Barbitarsis Freeman	W76-05795 5D
	(Diptera: Chironomidae) in the Benthos of a	
PREDATION	Shallow, Saline Lake,	PUBLIC HEALTH
Effect of Running Water on the Predatory Effi-	W76-06142 5C	Protecting Groundwater from Landfill
ciency of the Larvivorous Fish Cambusia Af-	BROJECT BENEFITS	Leachate,
finis,	PROJECT BENEFITS Monetary Values of Life and Health.	W76-05599 5G
W76-06021 2I	W76-05812 6F	The Safe Drinking Water Act of 1974: A
The Effects of Size-Selection Predation and	H /0-03012 OF	Management Impact Statement.
Environmental Variation on the Distribution	PROJECT FEASIBILITY	W76-05656 5G
	Structuring Communications Programs for	
and Abundance of a Chironomid, Paraborniella Tonnoiri Freeman.	Public Participation in Water Resources	Comparative Risk-Cost-Benefit Study of Alter-
	Planning,	native Sources of Electrical Energy,
W76-06130 2I	W76-05652 6B	W76-05829 6B
PRESSURE	PROJECT PLANNING	Reserve Mining Co. V. Environmental Protec-
Effect of the Operational Temperature in	Structuring Communications Programs for	tion Agency (Action by U. S. and Minnesota to
Reverse Osmosis Method (Gyaku shinto ho ni	Public Participation in Water Resources	Prevent Discharge of Taconite Tailings into
okeru sosa ondo no eikyo),	Planning,	Water of Lake Superior by Processing Com-
W76-05592 5D	W76-05652 6B	pany).
		W76-06107 6E
PRESSURE SEWERS	Social Impacts of Integrated River Basin	PUBLIC LAW 92-500
Plastic Pipe, Pressure Sewers, Mark Expan-	Development on Local Populations,	Interim Report on the Impact of Public Law 92-
sion,	W76-05755 6A	500 on Municipal Pollution Control Technolo-
W76-05765 5D	Multipurpose River Project Planning in the	gy,
PREVENTIVE MAINTENANCE	Lower Mekong Basin: A Decision Approach,	W76-05867 5D
Rig Restoration.	W76-05762 6A	
W76-05555 8G		PUBLIC PARTICIPATION
	Environmental Impact Assessment as an In-	Structuring Communications Programs for
PRICING	strument of Public Policy for Controlling Economic Growth,	Public Participation in Water Resources Planning,
Costs as a Guide to Pricing,	W76-05828 6G	W76-05652 6B
W76-05570 6C	11 70 03020	W 10 03032
0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Application of Multi-Regional Planning Models	PUBLIC UTILITIES
Supply and Demand in Water Planning:	to the Scheduling of Large-Scale Water	Financing the New Water Authorities,
Streamflow Estimation and Conservational	Resource Systems Development,	W76-05810 6C
Water Pricing, W76-05607 6D	W76-05846 6A	Industrial Cost Passavers and Hear Character
W76-05607 6D	PROJECT POST-EVALUATION	Industrial Cost Recovery and User Charge As- sessments,
PRIMARY PRODUCTIVITY	Sociological Analysis of Dam Impact: A Study	W76-05813 5G
Effect of Environmental Factors on Standing	of Twenty-Two Large Dams in Texas,	
Crop of Plankton in British Columbia Lakes,	W76-05501 6B	Oliver V. Hyle (Termination of Water and
W76-05741 5C		Sewer Services for Failure to Pay Arrearages
	Some Economic and Decision Aspects of the	Denial of Due Process).
Primary Production,	Canyon Project,	W76-06094 6E
W76-05874 5C	W76-05505 6B	PUERTO RICO
PRINTING INDUSTRY	PROJECTIONS	Application of Multi-Regional Planning Models
	A Digital-Computer Model for Estimating	to the Scheduling of Large-Scale Water
Biological Treatment by a System of Activated Sludge Applied to the Effluent Waters of a	Hydrologic Changes in the Aquifer System in	Resource Systems Development,
Corrugated Board Plant,	Dane County, Wisconsin,	W76-05846 6A
W76-05713 5D	W76-05851 2F	DUCET COUND OW A CITY
30	PROJECTS	PUGET SOUND (WASH) Distribution and Structure of Benthic Assem-
PROBABILITY	A Review of Some Hydrological Studies	blages in Puget Sound, Washington, USA,
Continuous Seasonal Probability of Extreme	Required in the Design of Water Management	W76-06015 5B
Rainfall Events,	Projects.	
W76-05692 2B	W76-05517 4A	PULP AND PAPER INDUSTRY
Commission of Pine is it. Put at a second		Hydraulic Load Fluctuation in Effluent Treat-
Correction of Bias in the Estimation of the	Minimizing the Operating and Capital Costs of	ment Plants (Hydraulicke narazy na sedimen-
Coefficient of Skewness, W76-05910 2E.	Water Supply Projects,	tacni cistirny odpadnich vod),
W76-05910 2E	W76-05522 6A	W76-05699 5D

P

4A Case 4A oject 6B

natal sopis 5G wage 5D ndfill 5G 4: A 5G Alter-

otecota to into Com-

6E

w 92-nolo-5D for urces 6B

6C e As-5G and rages 6E

odels Vater 6A sem-5B reatmen-

5D

mental Protection Requirements (Die Position einer Kalziumbisulfitfabrik, besonders im Hin- blick auf verschaerfte Umweltschutzforderun- gen),	RADIOISOTOPES Plutonium Concentrations in Water and Suspended Sediment from the Miami River Watershed, Ohio,
W76-05722 5G	W76-05887 5B
Escher-Wyss Flotation Cells for Clarification and Cleaning (Die Escher-Wyss Flotationszel-	The Chemical Speciation of PU-239, PU-240 and CS-137 in Lake Michigan Waters,
	W76-05889 5B
Optimizing Organic Carbon and Color Removal	Effect of Municipal Treatment Processes on PU-239, PU-240, and CS-137, W76-05890 5F
W76-05724 5D	
Activated Carbon Treatment of Pulp and Paper	Sedimentary Pu-239, Pu-240 Phase Distribu- tions in Lake Michigan Sediments,
W76-05730 5D	W76-05891 5B
Chemical Characterization of Fiber Building	The Distribution of Plutonium in Lake Michigan Sediments,
The state of the s	W76-05892 5B
W/6-03/31 3A	Controlled of Footbooks by Well and
Distribution of Lignin in Waters of the Lou-	Contamination of Freshwater by Mn54 and Co60,
	W76-05903 5C
from Production of Chemical Pulp (La dis-	RAIN GAGES
tribuction de la lignina en aguas de la ensenada de lourizan, comomedida de la contaminacion a	Design and Results of Comparative Tests of a Rainfall Recorder Operating for a Week
causa del vertido de lejuas ligninsulfonicas,	(WRR),
losa),	W76-05674 7B
W76-05733 5G	On Radar-Raingage Comparison,
Municipal Plant Handles 44% Pulp and Paper	W76-05694 2B
Mill Wastes,	RAINBOW TROUT
W76-05778 5D	Comparative Toxicity of Polyelectrolytes to
PUMP TESTING	Selected Aquatic Animals, W76-05740 5C
Colorado City Solves its Sand Pumping	W 10-03140
	RAINFALL
W 76-03339	Design and Results of Comparative Tests of a Rainfall Recorder Operating for a Week
PUMPING	(WRR),
Typified by a Sewage Pumping Installation,	W76-05674 7B
W76-05591 5D	Trend Analysis of Annual Indian Rainfall,
Pumping-Test Analysis Using a Discrete Time-	W76-05691 2B
Discrete Space Numerical Method,	Continuous Seasonal Probability of Extreme
W76-05913 4B	Rainfall Events,
RADAR	W76-05692 2B
On Radar-Raingage Comparison,	Statistics of Raingage Data,
W76-05694 2B	W76-05693 2B
Possibility of Determining the Areas of Heavy	O. B. L. B. i G
Precipitation by Discrete Representation of	On Radar-Raingage Comparison, W76-05694 2B
Radar Data, W76-05933 2B	Possibility of Determining the Areas of Heavy
RADAR-RAINFALL MEASUREMENTS	Precipitation by Discrete Representation of
On Radar-Raingage Comparison,	Radar Data,
W76-05694 2B	W76-05933 2B
RADAR-RAINFALL RELATIONSHIPS	RAINFALL DISPOSITION
On Radar-Raingage Comparison,	Statistics of Raingage Data, W76-05693 2B
W76-05694 2B	11.00000
RADIO WAVES	RAINFALL INTENSITY
RADIO WAVES Internal Reflections in Polar Ice Sheets, W76-05681 2C	Statistics of Raingage Data,
Internal Reflections in Polar Ice Sheets, W76-05681 2C RADIOACTIVE STRONTIUM	Statistics of Raingage Data, W76-05693 2B RAINFALL-RUNOFF RELATIONSHIPS
Internal Reflections in Polar Ice Sheets, W76-05681 2C RADIOACTIVE STRONTIUM Reclamation of Soils Contaminated with	Statistics of Raingage Data, W76-05693 2B RAINFALL-RUNOFF RELATIONSHIPS Dependable Yield of Reservoirs with Intermit-
Internal Reflections in Polar Ice Sheets, W76-05681 2C RADIOACTIVE STRONTIUM	Statistics of Raingage Data, W76-05693 2B
Internal Reflections in Polar Ice Sheets, W76-05681 2C RADIOACTIVE STRONTIUM Reclamation of Soils Contaminated with Radioactive Strontium, W76-05906 5G	Statistics of Raingage Data, W76-05693 2B RAINFALL-RUNOFF RELATIONSHIPS Dependable Yield of Reservoirs with Intermittent Inflows, W76-05908 4A
Internal Reflections in Polar Ice Sheets, W76-05681 2C RADIOACTIVE STRONTIUM Reclamation of Soils Contaminated with Radioactive Strontium,	Statistics of Raingage Data, W76-05693 2B RAINFALL-RUNOFF RELATIONSHIPS Dependable Yield of Reservoirs with Intermit- tent Inflows,
	einer Kalziumbisulfitfabrik, besonders im Hinblick auf verschaerfte Umweltschutzforderungen), W76-05722 Escher-Wyss Flotation Cells for Clarification and Cleaning (Die Escher-Wyss Flotationszellen zur Klaerung und Reinigung), W76-05723 Optimizing Organic Carbon and Color Removal from a Board Mill Effluent, W76-05724 Activated Carbon Treatment of Pulp and Paper Waste Water, W76-05730 Chemical Characterization of Fiber Building Board Mill Effluent, W76-05731 Distribution of Lignin in Waters of the Lourizan Inlet as a Measure of Contamination Due to Dumping of Lignosulfonic Liquors Resulting from Production of Chemical Pulp (La distribuction de la lignina en aguas de la ensenada de lourizan, comomedida de la contaminacion a causa del vertido de lejuas ligninsulfonicas, procedentes de la fabricacion de pasta de celulosa), W76-05733 5G Municipal Plant Handles 44% Pulp and Paper Mill Wastes, W76-05778 PUMP TESTING Colorado City Solves its Sand Pumping Problems, W76-05599 PUMPING Technical-Economic Product Design as Typified by a Sewage Pumping Installation, W76-05591 Pumping-Test Analysis Using a Discrete Time-Discrete Space Numerical Method, W76-05913 RADAR On Radar-Raingage Comparison, W76-05694 Possibility of Determining the Areas of Heavy Precipitation by Discrete Representation of Radar Data, W76-05933 2B RADAR-RAINFALL MEASUREMENTS On Radar-Raingage Comparison, W76-05694 Page Properties of Comparison, W76-05694 PRADAR-RAINFALL MEASUREMENTS On Radar-Raingage Comparison, W76-05694 Page Properties of Comparison, W76-05694 Page Properties of Caracterization Properties of Properties of Properties Pro

RES D W

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REAL PROPERTY

REAL PROPERTY City of Los Angeles V. Ricards (Flood Destruc-	REGIONAL ANALYSIS The Master Plan for Water Supply in the Re-	Supply and Demand in Water Planning: Streamflow Estimation and Conservational
tion of Private Bridge Causes Loss of Access	gional Municipality of Ottawa-Carleton,	Water Pricing,
and Depreciation of Property Value-Inverse Condemnation).	W76-05815 6D	W76-05607 6D
W76-06112 6E	Regional Water Exchange for Drought Allevia-	RESERVOIR IMPACT Sociological Analysis of Dam Impact: A Study
REAL-TIME MANAGEMENT	tion, W76-05819 4A	of Twenty-Two Large Dams in Texas,
Real-Time Management of Water-Resource	Application of Multi-Regional Planning Models	W76-05501 6B
Systems, W76-05747 6A	to the Scheduling of Large-Scale Water Resource Systems Development,	An Evaluation of Some Recreational, Demo- graphic and Economic Impacts of Canyon
REASONABLE USE	W76-05846 6A	Lake,
Illinois Drainage LawThe Dominant Estate	REGIONAL DEVELOPMENT	W76-05506 6B
Owner May Not Increase the Rate or Amount of Surface Water Run-Off onto the Servient	A Rural Mississippi Success Story: Alcorn County's Water System.	RESERVOIR OPERATION Hydrologic Implications of Canyon Dam and
Estate Beyond a Range Consistent with a Pol- icy of Reasonable Use,	W76-05657 6D	Reservoir,
W76-06051 4A	Quebec's Water and Sewage Masterplan for	W76-05503 2H
Story V. Hefner (Deeds Purporting to Divide	Mirabel Region.	Reservoir Management Via Reliability Pro- gramming,
Lake in Half Ineffective to Prohibit Use of Entire Surface for Recreational Purposes).	W76-05793 5D	W76-05508 4A
W76-06102 6E	Utah's Third Year of Planning for the Four Corners Regional Commission,	Dependable Yield of Reservoirs with Intermit-
Butler V. Bruno (Deflection of Surface	W76-05827 6B	tent Inflows, W76-05908 4A
Waters).	REGIONAL ECONOMICS	
W76-06110 6E	How to Guide Growth in Southeastern New	RESERVOIR OPTIMIZATION Comment Upon Multivariate Synthetic
RECREATION	England, Parts I, II and IV of the Draft Report. W76-05649 6G	Hydrology,
An Evaluation of Some Recreational, Demo-		W76-05909 2A
graphic and Economic Impacts of Canyon Lake,	Application of Multi-Regional Planning Models to the Scheduling of Large-Scale Water	RESERVOIR RELEASES
W76-05506 6B	Resource Systems Development,	Reservoir Management Via Reliability Pro- gramming,
Plan Formulation and Evaluation Studies	W76-05846 6A	W76-05508 4A
Recreation. Vol. II of V. Estimating Initial	REGULATION	RESERVOIR YIELD
Reservoir Recreation Use, W76-05611 6B	The Safe Drinking Water Act of 1974: A Management Impact Statement.	Dependable Yield of Reservoirs with Intermit- tent Inflows.
Hanlon Creek Ecological Study, Phase B.	W76-05656 5G	W76-05908 4A
W76-05650 6G	The Economics of Alternative Deep Seabed	RESERVOIRS
RECYCLING	Regimes,	Sociological Analysis of Dam Impact: A Study
Filtering Apparatus and Process,	W76-05816 6E	of Twenty-Two Large Dams in Texas, W76-05501 6B
W76-05546 5D	Corps Issues Interim Rules for Discharges of	
Carbon Wastewater Treatment Process.	Dredged and Fill Materials. W76-06061 5G	The Impact of Canyon Dam and Reservoir on Wildlife,
W76-05583 5D		W76-05504 6G
Wastewater Renovation and Reuse: An Urgent	Plastics and Synthetics Point Source Category (Proposed Effluent Limitations and	Some Economic and Decision Aspects of the
Environmental Need,	Guidelines).	Canyon Project,
W76-05777 5D	W76-06086 5G	W76-05505 6B
Lime Recovery and Reuse in Primary Treat-	RELATIVE RIGHTS	An Evaluation of Some Recreational, Demo-
ment, W76-05785 5D	Shaub V. Fifth Judicial District (Adjudication of Water Rights in Main Stream Also an Adju-	graphic and Economic Impacts of Canyon Lake,
	dication of Rights in Tributaries),	W76-05506 6B
Converting Sewage into Savings. W76-05790 5D	W76-06104 6E	Reservoir Management Via Reliability Pro-
W 10-05/70	RELIABILITY	gramming,
Incineration's Role in Ultimate Disposal of Process Wastes,	Reservoir Management Via Reliability Pro-	W76-05508 4A
W76-05791 5E	gramming, W76-05508 4A	Plan Formulation and Evaluation Studies-
Sewage Treatment and Recycling System,	RESEARCH AND DEVELOPMENT	Recreation. Vol. II of V. Estimating Initial Reservoir Recreation Use,
W76-05988 5D	Radiological and Environmental Research Divi-	W76-05611 6B
Occurrence of Phytophthora Species and Other	sion Annual Report - Ecology, January- December 1974.	Eutrophic Gradient in Smith Mountain Lake,
Potential Plant Pathogens in Recycled Irrigation	W76-05879 5C	Virginia, W76-05627 5C
Water, W76-06010 5C	RESERVOIR CAPACITY	
REFLECTANCE	A Review of Some Hydrological Studies	Water's Most Efficient System. W76-05655 60
Internal Reflections in Polar Ice Sheets,	Required in the Design of Water Management Projects.	Table of Data on Water Quality of Baker Lake
W76-05681 2C	W76-05517 4A	near Mount Baker, Washington,
REGELATION	RESERVOIR DESIGN	W76-05857 7C
The Movement of Melting Ice over Rough Sur-	Hydrologic Implications of Canyon Dam and	Introduction and Physical Description of Lake
faces, W76-05671 2C	Reservoir, W76-05503 2H	Norman, W76-05871

ning: ional 6D tudy 6B emo-nyon 6B and 2H Pro-4A rmit-4A netic 2A Pro-4A mit-4A udy 6B on 6G the 6B moyon 6B ro-4A es--itial 6B ke, 5C 6C ake 7C ike 5C

RESIDENCE TIMES	REVIEWS	Goals and Forms of Co-operation Among
Discharge Residence of TLD Tagged Fish, W76-05898 5C	Evaluation of Quality Parameters in Water Resource Planning: A State-of-the-Art Survey	Countries for the Development of International River Basins.
RESIDUAL DRAWDOWN DATA	of the Economics of Water Quality,	W76-05521 4A
Determining Aquifer Coefficients from	W76-05818 5G	Hanlon Creek Ecological Study, Phase B.
Residual Drawdown Data,	Sewer Flow Measurement - A State-Of-The-Art	W76-05650 6G
W76-05689 2F	Assessment,	
RESINS	W76-05865 5D	Urban Water Management of an International River: The Case of El Paso -Juarez.
Purification of Gum Rosin Producing Plant Ef-	Interim Report on the Impact of Public Law 92-	W76-05661 3D
fluents from Resinous Substances (Ochistka stochnykh vod kanifol'noterpentinnogo proiz-	500 on Municipal Pollution Control Technolo-	
vodstva ot smolistykh veshchestv),	gy,	Water Management Control System for the
W76-05735 5D	W76-05867 5D	Zagyva-Tarna River Basin, W76-05746 4A
Nitrate Removal from Water by Ion Exchange,	RHIZOSPHERE	•
W76-05806 5F	Statistical Study of the Duckweed Rhizosphere	Ex-Post Evaluation of River Basin Develop-
Method of Treating Waste Liquids from Photo-	as an Eco-Assay Tool, W76-05605 5B	ments in Pakistan, W76-05748 6A
graphic Processings,	W 70-03003	
W76-05963 5D	RHODE ISLAND	Decision Making and Planning for River Basin
Plastics and Synthetics Point Source Category	Butler V. Bruno (Deflection of Surface	Development, W76-05752 6A
(Proposed Effluent Limitations and	Waters). W76-06110 6E	W 10-03/32 6A
Guidelines).	W10 00110	Inter Basin Transfer of Water Resource Case
W76-06086 5G	RHONE RIVER (FRANCE)	Study of Indus Project,
RESISTIVITY	Proposal for a Trans-Mediterranean Aqueduct, W76-05660 4A	W76-05753 4A
A Driller's Good Friend - The Electric Logger,	W76-05660 4A	Technical-Economic Planning of the Gab-
W76-05561 8G	RICE	cikovo-Nagymaros Barrage Project for the
Vertical Electrical Resistivity Soundings to	Effect of Different Methods of Planting in Pud-	Development of the Central-Danube Basin, W76-05754 4A
Locate Ground Water Resources: A Feasibility	dled Soil on the Yield of Rice, W76-06017	W76-05754 4A
Study, W76-05835 4B	W76-06017 3F	Social Impacts of Integrated River Basin
	RIO GRANDE RIVER	Development on Local Populations,
RESOURCE MANAGEMENT	Urban Water Management of an International	W76-05755 6A
Proceedings - Conference on Water Conserva- tion and Sewage Flow Reduction with Water-	River: The Case of El Paso -Juarez, W76-05661 3D	International Management of the River Plate
Saving Devices.	W 70-03001	Basin,
W76-05602 5D	RIPARIAN RIGHTS	W76-05756 4A
RESOURCES DEVELOPMENT	Lingo V. City of Jacksonville (Authority of	Simulation as a Tool in International River
The Taking Issue: Potential Obstacle to natural	City to Pump Subterranean Water). W76-06092 6E	Development,
Resource Management Legislation,	W. 00002	W76-05757 6A
W76-06055 6E	RISKS	International River Basin Cooperation: Some
The Washington Shoreline Management Act,	Uncertainty in Water Resources Decision Mak-	Factors Influencing Agreement,
W76-06056 5G	ing, W76-05513 6A	W76-05758 6E
Coastal Zone Management and Intergovern-		Legal Framework of Co-Operation in the Field
mental Coordination,	Costs as a Guide to Pricing,	of Water Management Between Hungary and
W76-06057 6E	W76-05570 6C	Her Neighboring Countries,
RETURN FLOW	RIVER BASIN DEVELOPMENT	W76-05759 6E
Salt Transport in Soil Profiles with Application	Environmental Considerations in River Basin	Long Range Planning of Water Resources: A
to Irrigation Return Flow, The Dissolution and Transport of Gypsum in Soils,	Planning and Decision Making, W76-05510 4A	Multi Objective Approach,
W76-05836 5B		W76-05760 6A
REVEGETATION	The Role of Inland Navigation in River Basin	Multipurpose River Project Planning in the
Precipitation Management for Reclamation of	Development, W76-05511 4A	Lower Mekong Basin: A Decision Approach,
Overgrazed Areas in Arid and Semi-Arid Re-	44	W76-05762 6A
gions,	Systems Approach to River Basin and Inter-	RIVER BASINS
W76-05603 2B	basin Development, W76-05512 4A	Water Resources Development in the Tisza
Effect of Surface Applied Sulfuric Acid on		River Basin and Its Impact on Socio-Economic
Water Penetration into Dry Calcareous and Sodic Soils.	Uncertainty in Water Resources Decision Mak-	Growth, W76-05519 4A
W76-05907 5G	ing, W76-05513 6A	W76-05519 4A
	W76-05513 6A	Water Resources Development in the Ganga-
REVERSE OSMOSIS Effect of the Operational Temperature in	A Case Study Report on the Vistula River	Ghagra Interbasin in Uttar Pradesh (India),
Reverse Osmosis Method (Gyaku shinto ho ni	Basin,	W76-05763 4A
okeru sosa ondo no eikyo),	W76-05514 4A	RIVER ECOSYSTEMS
W76-05592 5D	River Basin Models and Their Application with	Plutonium in Aquatic Biota of the Great Miami
Reverse Osmosis Plant Helps City Cope with	Scarcity of Data.	River Watershed, Ohio,
Diminishing Groundwater Supply,	W76-05516 4A	W76-05888 5C
W76-05779 5F	Views on River Basin Development in Thai-	RIVER FLOW
Reverse Osmosis Separation Apparatus,	land, W76-05520 4A	Wind Effects on Stream Flows, W76-05921 2E
W76-05990 3A	W76-05520 4A	W76-05921 2E

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RIVERS	ROOT ZONE	Effect of Depth and Salinity of Ground Water
Report on Water Quality and Waste-Source in-	Water Movement Within the Root Zone of Ir-	on Evaporation and Soil Salinization,
vestigations, Big Sioux River and Selected	rigated and Nonirrigated Grain Sorghum,	W76-06036 2D
Tributaries.	W76-05994 2G	
W76-05626 5C		SALMON
	ROTARY DRILLING	Estimating Dry Weight of Live,
Detergent Phosphate Ban Yields Little	Air Rotary Drilling with Organic Polymers Of-	Unanesthetized Fish by Photography,
Phosphorus Reduction, Part I,	fers Many Benefits,	W76-05615 5A
W76-05637 5C	W76-05562 8B	
	BOTATING DISK SYSTEM	Sensitivity of Blood Cell Counts in Juvenile
Effect of Urbanization on the Quality of River	ROTATING DISK SYSTEM	Coho Salmon (Oncorhynchus Kisutch) to Stres-
Water,	Biological Nitrification of Sludge Supernatant	sors Including Sublethal Concentrations of Pulp
W76-05926 5B	by Rotating Disks,	Mill Effluent and Zinc,
	W76-05800 5D	W76-05696 5C
To Amend the Wild and Scenic Rivers Act (on	RUNOFF	
S. 10 and S. 1004).	Allowance for Precipitation and Runoff Fluc-	SALMONIDS
W76-06081 6E	tuation Patterns in Computing Water	Developments in Underwater Radiotelemetry
South Counting South Birms Asset 1974	Withdrawal for Irrigation Systems in the	and Preliminary Fish Tracking in Therma
South Carolina Scenic Rivers Act of 1974.	Southern Ukraine.	Plumes,
W76-06090 6E	W76-05675 4A	W76-05893 5C
DIVIDE AND WARDONS ACT	11.0-05015	
RIVERS AND HARBORS ACT	Estimate of the Effect of Flood-Plain Drainage	Comparison of the Movement and Recapture of
Reserve Mining Co. V. Environmental Protec-	on the Annual and Maximum Runoff of Small	Salmonid Fishes Tagged at Two Power Plants,
tion Agency (Action by U. S. and Minnesota to	Rivers in the Ukraine (Dnieper Basin),	W76-05894 50
Prevent Discharge of Taconite Tailings into	W76-05676 4A	O 1 1 A Fin China L Colored L College
Water of Lake Superior by Processing Com-		Origin of Fin-Clipped Salmonids Collected at
pany).	Slope Runoff and Its Change Under the Effect	Two Thermal Discharges on Lake Michigan,
W76-06107 6E	of Agricultural and Forest Improvement Prac-	W76-05895 5C
	tices,	County of Diama Basidant Pichas in Labor
United States V. Lewis (Action to Enjoin Con-	W76-05927 4C	Growth of Plume Resident Fishes in Lake
struction of a Causeway across a Tidal Marsh		Michigan,
without Permit Required Under the Rivers and	RURAL AREAS	W76-05901 50
Harbors Act).	A Rural Mississippi Success Story: Alcorn	Effect of Divers Decidence on the Assumula
W76-06108 6E	County's Water System.	Effect of Plume Residence on the Accumula-
	W76-05657 6D	tion of Cs137 by Lake Michigan Salmonids,
ROAD CONSTRUCTION		W76-05902 50
Impact of Clear-Cutting and Road Construction	RURAL ROADS	SALT EFFECTS
on Soil Erosion by Landslides in the Western	Reservoir Sedimentation Associated with	
Cascade Range, Oregon,	Catchment Attributes, Landslide Potential,	Interactions of Mercury with Aquatic and
W76-05614 4C	Geologic Faults, and Soil Characteristics,	Edaphic Environments,
	W76-05617 4D	W76-05601 5E
Sediment Characteristics of Five Streams Near		CALE TOLERANCE
Harrisburg, Pennsylvania, Before Highway	SAFE DRINKING WATER ACT OF 1974	SALT TOLERANCE
Construction,	The Safe Drinking Water Act of 1974: A	Effects of Salinity on Nitrification in the Eas
W76-05854 4C	Management Impact Statement.	River,
	W76-05656 5G	W76-05631 50
Road Standards on Steep Terrain in the Pacific	SALINE LAKES	Ionia I and Annumulation in Course Course
Northwest U.S.A. with Suggestions for Imple-	Seasonal Dynamics and Productivity of Tany-	Ionic Leaf Accumulation in Grapes, Guava and
mentation,		Olive Plants as Affected by the Salinity of Ir
W76-05948 4C		rigation Water,
	(Diptera:Chironomidae) in the Benthos of a	W76-06030 3C
Burton V. Douglas County (County Liability	Shallow, Saline Lake,	SALT TRANSPORT
for Flood Damages to Property Caused by	W76-06142 5C	
Faulty Road Construction).	Distribution of Fish in Inland Saline Waters in	Salt Transport in Soil Profiles with Application
W76-06105 6E	Victoria, Australia,	to Irrigation Return Flow, The Dissolution and
	W76-06143 2H	Transport of Gypsum in Soils,
ROAD DESIGN	W 70-00143	W76-05836 5E
Road Standards on Steep Terrain in the Pacific	SALINE SOILS	SAMPLING
Northwest U.S.A. with Suggestions for Imple-	Effect of Depth and Salinity of Ground Water	
mentation,	on Evaporation and Soil Salinization,	An Assessment of Automatic Sewer Flow Sam
W76-05948 4C	W76-06036 2D	plers - 1975,
+0		W76-05864 5I
ROANOKE RIVER (VIRGINIA)	SALINE WATER	American for Collection Surface Postials and
Eutrophic Gradient in Smith Mountain Lake,	Multistage Flash Evaporator for Producing Soft	Apparatus for Collecting Surface Particle of
Vîrginia,	Water from a Saline Water,	W76-05970 50
W76-05627 5C	W76-05978 3A	W76-05970 50
30		SAN ANTONIO (TX)
ROCKY CREEK (CALIF.)	Method and Apparatus for Desalinization of	
Algal Nitrogen Fixation in Californian Streams:	Water,	Water's Most Efficient System.
Seasonal Cycles,	W76-05979 3A	W76-05655 60
W76-05639 5C	CALINE WATER PROPERTY AND INCOME.	SAN JACINTO VALLEY (CALIF)
30	SALINE WATER-FRESHWATER INTERFACES	
ROCKY MOUNTAIN REGION	Evaluation of Data Availability and Examples	Land Subsidence and Aquifer-System Compac
Response of Soil Testacea to Soil Moisture	of Modeling for Ground-Water Management on	tion in the San Jacinto Valley, Riverside Coun
Fluctuations,	Cape Cod, Massachusetts,	ty, CaliforniaA Progress Report,
W76-06038 2G	W76-05856 4B	W76-05847 21
26	SALINITY	SAND FILTRATION
ROOT SYSTEMS	Principal Economic Aspects of the Problem of	Old Slow Sand + New Rapid Filtration - Sedi
Water and Phosphate Transport to Plant Roots,	Salinity of the Colorado River,	
W76-06002 21	W76-05821 6E	mentation = Savings, W76-05808
21	11 10-03021 OE	W76-05808 51

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SAND PUMPING	SECCHI DISKS	SEDIMENTATION
Colorado City Solves its Sand Pumping	Development of Oxygen Deficits in 14	Reservoir Sedimentation Associated with
Problems, W76-05559 8C	Southern Ontario Lakes, W76-05679 SC	Catchment Attributes, Landslide Potential, Geologic Faults, and Soil Characteristics,
W 76-03339 8C	W76-05679 5C	W76-05617 4D
SASKATCHEWAN RIVER	SEDIMENT CONTROL	12
Yeasts Isolated from Some Lakes and Rivers	Impacts of Hydrologic Modification on Water	Fallout CS-137: A Tool in Conservation
of Saskatchewan,	Quality,	Research,
W76-06135 5B	W76-05866 5G	W76-05690 2J
SATURATION		Old Slow Sand + New Rapid Filtration - Sedi-
Water Quality Standards: Oregon (Withdrawal	SEDIMENT DISCHARGE	mentation = Savings,
of Proposed Rule Making).	A Stochastic Model of Dispersion of Sediment	W76-05808 5F
W76-06098 5G	Particles Released from A Continuous Source,	
	W76-05663 2J	SEDIMENTATION RATES
SAVANNA	SEDIMENT DISTRIBUTION	Fallout CS-137: A Tool in Conservation
Surface Energy Budget of Some Climatic	A Stochastic Model of Dispersion of Sediment	Research, W76-05690 2J
Regimes in West Africa,	Particles Released from A Continuous Source,	W 76-03690 23
W76-06006 2B	W76-05663 2J	SEDIMENTS
SCALING		Trace Element, Mineralogy, and Size Distribu-
Inhibition of Scale Deposition,	Sediment Characteristics of Streams in the	tion of Suspended Material Samples from
W76-05529 5D	Eastern Piedmont and Western Coastal Plain	Selected Rivers in Eastern Kansus,
	Regions of North Carolina,	W76-05606 5B
Method of Preventing Scale From Being	W76-05849 2J	Development of Oxygen Deficits in 14
Deposited In Case of Producing Fresh Water	SEDIMENT LOAD	Southern Ontario Lakes,
From Sea Water,	Impacts of Hydrologic Modification on Water	W76-05679 5C
W76-05971 3A	Quality,	W 70 03017
Desalination Process by Improved Multistage	W76-05866 5G	Control of Coagulant Recovery from Effluent
Electrodialysis,		Sediment (Kontrol' regeneratsii koagulyantov
W76-05980 3A	SEDIMENT TRANSPORT	iz osadka ctochnykh vod),
***	A Stochastic Model of Dispersion of Sediment	W76-05725 5E
SCHLUMBERGER ARRAY	Particles Released from A Continuous Source,	Distribution of Amorphous, Diatom Frustule,
Vertical Electrical Resistivity Soundings to	W76-05663 2J	and Dissolved Silica in a Lead-210 Dated Core
Locate Ground Water Resources: A Feasibility		from Southern Lake Michigan,
Study,	Equations for Resistance to Flow and Sediment	W76-05883 5C
W76-05835 4B	Transport in Alluvial Channels, W76-05844 2J	
SCOTLAND (EDINBURGH)	W76-05844 2J	The Distribution of Plutonium in Lake
Edinburgh's Sewage-Treatment and Disposal	Late Pleistocene and Holocene Depositional	Michigan Sediments,
Scheme,	Trends, Processes, and History of Astoria	W76-05892 5B
W76-05794 5D	Deep-Sea Fan, Northeast Pacific,	SEISMIC WAVES
	W76-05845 2L	Finite Element Mesh Gradation for Surface
SCOUR		Waves,
A Stable Numerical Model for Local Scour,	Sediment Characteristics of Streams in the	W76-05919 8E
W76-05666 2J	Eastern Piedmont and Western Coastal Plain	
SEA-GRASS	Regions of North Carolina,	SELECTOR SYSTEMS
The Fauna of Careel Bay with Comments on	W76-05849 2J	Selector Systems in Recording Physiological
the Ecology of Mangrove and Sea-Grass Com-	Sediment Characteristics of Five Streams Near	and Behavioral Activity in Sedentary Aquatic
munities,	Harrisburg, Pennsylvania, Before Highway	Animals, W76-06039 2I
W76-06022 2L	Construction,	W /6-06039
	W76-05854 4C	SELENIUM
SEA WATER		An Automated Technique for the Sub-Micro-
Method of Preventing Scale From Being	Role of Copepod Fecal Pellets in the Vertical	gram Determination of Selenium and Arsenic in
Deposited In Case of Producing Fresh Water From Sea Water,	Transport of Freshwater Diatoms,	Surface Waters by Atomic Absorption Spec-
W76-05971 3A	W76-05880 5C	troscopy,
17.0-937/1 3A	Vertical Transport of Bostonias Material	W76-05736 5A
SEASONAL	Vertical Transport of Particulate Material in	Determination of Selenium in Natural Waters
Continuous Seasonal Probability of Extreme	Lake Michigan by the Lorica of Codonella Cratera,	Using the Centrifugal Photometric Analyzer,
Rainfall Events,	W76-05881 5C	W76-06128 2K
W76-05692 2B	W 70-03981	
Zoonlankton Entrainment	SEDIMENT YIELD	SEPARATION TECHNIQUES
Zooplankton Entrainment, W76-05876 5C	Pine Management Influences the Southern	Emulsion Breaking Method,
	Water Resource,	W76-05527 5G
Effects of Season, Location, and Discharge	W76-05616 5B	Removal of Floating Pollutants,
Type on Fish Distribution and Density in Ther-	Sediment Chemotopics of States to the	W76-05533 5G
mal Plumes,	Sediment Characteristics of Streams in the	
W76-05896 5C	Eastern Piedmont and Western Coastal Plain Regions of North Carolina,	Apparatus for the Collection of Buoyant
On the Possibilities of Averaging the Seasonal	W76-05849 2J	Foreign Matter,
Pattern in Kjeldahl Nitrogen in a Group of		W76-05534 5G
Water Bodies,	Factors Influencing Infiltration and Sediment	Method and Apparatus for Centrifugally
W76-06019 5B	Production of Semiarid Rangelands in Nevada,	Separating Finely Divided Solids from Aqueous
	W76-05912 2G	Suspensions Thereof,
Breeding Places and Seasonal Incidence of	Hamastina Couthern Possess A Thurst As	W76-05543 5D
Acdes Acgypti, as Assessed by the Single-	Harvesting Southern Forests: A Threat to Water Quality,	Watercraft for Scavenging Oil Spillage,
Larva Survey Method, W76-06033 5G	W76-05945 5B	W76-05548 5G
30033		

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2J

SEPARATION TECHNIQUES

Port Collection and Separation Facilities for Oily Wastes. Vol. 5. A Comparative Analysis of	Biodegradation of Methanolic Waste Water, W76-05525 5D	Method and Apparatus for the Anaerobic Digestion of Decomposable Organic Materials,
Conceptual System Plans for the Surveyed Ports Under the 'No Discharge', '1969 Amend- ments' and 'No Sheen' Criteria,	Process for Biochemical Reactions, W76-05542 5D	W76-05981 5D Method of Treatment of Sludges With Size-Ad-
W76-05830 5D	Waste Water and Sewage Treatment.	justed Carbon,
Process for Separating Oil from Emulsions of	W76-05580 5D	W76-05985 5D
Oil in Water, W76-05964 5D	Submerged Air Release Device Particularly for	Methods and Apparatus for Treating Waste- water,
	Sewage Treatment, W76-05581 5D	W76-05987 5D
Method of Treatment of Sludges With Size-Ad- justed Carbon,		Sewage Treatment and Recycling System,
W76-05985 5D	Sewage Treatment, W76-05582 5D	W76-05988 5D
Apparatus for the Separation of Liquid Mix-		Commonwealth, Department of Natural
tures My Means of Permeability Selective Separation Membranes,	Carbon Wastewater Treatment Process. W76-05583 5D	Resources V. Westmoreland-Fayette Municipal Sewage Authority (Appeal by Municipal Entity
W76-05991 3A	Removal of Ammonia Nitrogen by Catalytic	from Order to Curb Discharge of Untreated Sewage into Waters of Pennsylvania.,
Recovering Bitumen from Large Water Surfaces,	Oxidation Filter Bed (Sesshoku sanka rosho ni yoru ammonia-set chisso no jokyo),	W76-06115 6E
W76-05992 5G	W76-05589 5D	SEWERAGE
SEPARATION TECHNIQUS	Technical-Economic Product Design as	Rehabilitating an 80-Year Old Sewer System, W76-05764 5D
Method of Extracting Heavy Metals from In-	Typified by a Sewage Pumping Installation,	
dustrial Waste Waters, W76-05966 5D	W76-05591 5D	Plastic Pipe, Pressure Sewers, Mark Expan- sion,
SEPTIC TANKS	Perspective 75. W76-05651 6B	W76-05765 5D
Regional Plant Treats Septic Wastes,		Factors in the Purification of Flowing Sewage
W76-05771 5D	Rehabilitating an 80-Year Old Sewer System, W76-05764 5D	and Activated Sludge Process, Part I, W76-05795 5D
SESTON Development of Oxygen Deficits in 14	Brooklyn Plant Meets Major Challenges,	
Southern Ontario Lakes,	W76-05768 5D	SEWERS Decision Perspectives on Urban Storm Water
W76-05679 5C	Phosphorus Removal from Static Sewage Ef-	Pollution,
SETTLING BASINS	fluent Using Duckweed,	W76-05509 5D
Method of Reducing Sludge Accumulation from Tar Sands Hot Water Process,	W76-05775 5D	Rehabilitating an 80-Year Old Sewer System, W76-05764 5D
W76-05965 5D	Municipal Plant Handles 44% Pulp and Paper Mill Wastes,	
SEWAGE	W76-05778 5D	An Assessment of Automatic Sewer Flow Sam- plers - 1975,
An Assessment of Automatic Sewer Flow Sam- plers - 1975,	Converting Sewage into Savings.	W76-05864 5D
W76-05864 5D	W76-05790 5D	SHIVERS
Method for the Primary and Secondary Treat-	Quebec's Water and Sewage Masterplan for	Food Habits of the Rough Shiner, Notropis
ment of Wastewater in a Unitary Apparatus,	Mirabel Region.	Baileyi Suttkus and Raney, in Halawakee Creek, Alabama,
W76-05972 5D	W76-05793 5D	W76-06126 2I
Michigan Wastewater Reporting and Surveil- lance Fees Rules.	Factors in the Purification of Flowing Sewage	SHORE ICE
W76-06067 5G	and Activated Sludge Process, Part I, W76-05795 5D	Lake and Shore Ice Conditions on Southeast- ern Lake Michigan in the Vicinity of the
SEWAGE DISPOSAL	Minimal Cost Plant Cleaning Up Harbor,	Donald C. Cook Nuclear Plant: Winter 1973-74,
Edinburgh's Sewage-Treatment and Disposal Scheme,	W76-05796 5D	W76-05664 2C
W76-05794 5D	Aerated Lagoons Solve Town's Site Problems,	SHORE PROTECTION Underwater Wall Structure,
Commonwealth, Department of Natural	W76-05799 5D	W76-05523 8A
Resources V. Westmoreland-Fayette Municipal Sewage Authority (Appeal by Municipal Entity	An Evaluation of the Use of Gamma Radiation in Sewage Treatment,	SHOWER AREAS
from Order to Curb Discharge of Untreated	W76-05803 5D	Possibility of Determining the Areas of Heavy
Sewage into Waters of Pennsylvania., W76-06115 6E	Effect of Municipal Treatment Processes on	Precipitation by Discrete Representation of Radar Data,
	PU-239, PU-240, and CS-137,	W76-05933 2B
SEWAGE EFFLUENTS Phosphorus Removal from Static Sewage Ef-	W76-05890 5F	SIBERIA
fluent Using Duckweed,	Process and Equipment for Automatic Chemi- cal-Biological Wastewater Treatment with	Exploitation of the Waters of Subpermafrost Artesian Basins,
	Provisions for Recycle and Reuse,	W76-05930 3B
Evaporator-Condenser Unit for Producing Potable Water From Sewage,	W76-05955 5D	SILICA
W76-05960 5D	Wastewater Treatment,	Distribution of Amorphous, Diatom Frustule,
SEWAGE SLUDGE	W76-05961 5D	and Dissolved Silica in a Lead-210 Dated Core from Southern Lake Michigan,
Carbon Wastewater Treatment Process.	Process for Separating Oil from Emulsions of Oil in Water,	W76-05883 5C
W76-05583 5D	W76-05964 5D	SILTING RATES
SEWAGE TREATMENT Method of Biological Purification of Sewage,	Sewage Treatment System,	Fallout CS-137: A Tool in Conservation Research,
W76-05524 5D	W76-05969 5D	W76-05690 2J

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2J

SILVER	Guidelines for Characterizing Naturally Unsta-	Method of Treatment of Sludges With Size-Ad-
Silver in Photoprocessing Effluents,	ble or Potentially Unstable Slopes on Western	justed Carbon,
W76-05732 5D	National Forests, W76-05621 4D	W76-05985 5D
SILVER IODIDE	W 70-03021	SMALL WATERSHEDS
Field Observations of the Persistence of AgI-	Interpreting Stability Problems for the Land	Sediment Characteristics of Five Streams Near
NH4I-Acetone Ice Nuclei in Daylight, W76-05677 3B	Manager, W76-05947 4D	Harrisburg, Pennsylvania, Before Highway Construction,
	W76-05947 4D	W76-05854 4C
SIMULATION ANALYSIS	SLOPES	
Removal of Ammonia Nitrogen by Catalytic Oxidation Filter Bed (Sesshoku sanka rosho ni	Slope Runoff and Its Change Under the Effect	SMITH MOUNTAIN LAKE (VIRGINIA)
yoru ammonia-set chisso no jokyo),	of Agricultural and Forest Improvement Prac-	Eutrophic Gradient in Smith Mountain Lake, Virginia,
W76-05589 5D	tices, W76-05927 4C	W76-05627 5C
Position of Picts Testing of a Position	40	
Development and Field Testing of a Basin Hydrology Simulator,	SLUDGE	SNAILS
W76-05745 2A	Liquid Purifying Process,	Some Helminths of Bulinus Truncatus and Biomphalaria Alexandrina from the Irrigation
at the second of the second of the	W76-05528 5D	System Near Cairo.
Simulation as a Tool in International River Development,	Processing of Sediments from Coagulation Ap-	W76-06028 5A
W76-05757 6A	plied as the Third Stage of Effluent Purification	SNOW
	(Przerabianie osadow powstajacych przy	Sublimation or Melting: Observations from the
SIOUX FALLS (S.D.)	zastosowaniu koagulacji jako trzeciego stopnia	White Mountains, California and Nevada,
Report on Water Quality and Waste-Source In- vestigations, Big Sioux River and Selected	oczyszczania sciekow z przemysłu włokiennic- zego),	U.S.A.,
Tributaries.	W76-05697 5D	W76-05683 2C
W76-05626 5C		Snow Accumulation and Melting in the Forest
SIPHON	SLUDGE DISPOSAL Water Clarification Settler.	and in Clear-Cut Areas in the Central Ural,
Siphon System Yields Chilean Plant More	W76-05578 SF	W76-05929 2C
Water,	1170 03370	SNOW COVER
W76-05550 8C	Experiments on the Optimization of Sludge De-	Plant Development Under Snow,
SIPHON SYSTEM HYDRAULICS	watering and on the Use of Bark and Sludge in	W76-06147 2I
Siphon System Yields Chilean Plant More	the Brick Industry (Versuche Zur Optimierung	
Water,	der Schlammentwaesserung und zur Verwer- tung von Rinde und Schlamm in der Ziegelin-	SNOWPACKS Snow Accumulation and Melting in the Forest
W76-05550 8C	dustrie),	and in Clear-Cut Areas in the Central Ural,
SIPHONS	W76-05704 5D	W76-05929 2C
Cathodic Inner and Outer Protection for a Dou-	SLUDGE LAGOON SUPERNATANTS	
ble Syphon for Waste Water (Kathodischer	Biological Nitrification of Sludge Supernatant	SOCIAL ASPECTS Social Science Data Banks and the Institute for
Innen-und Aussenschutz Fuer Einen Abwasser-	by Rotating Disks,	Water Resources,
Doppeldueker), W76-05584 5D	W76-05800 5D	W76-05822 6B
35	CLUB CE TREATMENT	Williams to Day on a Debasional Coltagion
Classification of Methods of Groundwater	SLUDGE TREATMENT Experiments on the Optimization of Sludge De-	Willingness to Pay as a Behaviourial Criterion for Environmental Decision-Making,
Management (Klassificaksiiya metodov upravleniya rezhimom i resursami podzemnykh	watering and on the Use of Bark and Sludge in	W76-05826 5G
vod),	the Brick Industry (Versuche Zur Optimierung	COCKAT TARKOT
W76-05600 4B	der Schlammentwaesserung und zur Verwer-	SOCIAL IMPACT Sociological Analysis of Dam Impact: A Study
SITES	tung von Rinde und Schlamm in der Ziegelin-	of Twenty-Two Large Dams in Texas,
Effects of Season, Location, and Discharge	dustrie), W76-05704 5D	W76-05501 6B
Type on Fish Distribution and Density in Ther-	30	An Evaluation of Comp Beautional Bonn
mal Plumes,	Control of Coagulant Recovery from Effluent	An Evaluation of Some Recreational, Demo- graphic and Economic Impacts of Canyon
W76-05896 5C	Sediment (Kontrol' regeneratsii koagulyantov	Lake,
Reforming Procedures for Industrial Siting,	iz osadka ctochnykh vod), W76-05725 5E	W76-03506 6B
W76-06058 6E		Social Impacts of Integrated River Basin
SKEW COEFFICIENT	Experiences and Possibilities with the Andritz-	Development on Local Populations,
Correction of Bias in the Estimation of the	Sem Double Wire Press for Sludge Dewatering,	W76-05755 6A
Coefficient of Skewness,	Particularly in the Paper, Pulp and Board In- dustry (Erfahrungen und Moeglichkeiten mit	Social Impact Assessment: An Analytic
W76-05910 2E	der Andritz-Sem Doppelsiebpresse bei der	Bibliography,
SKIMMING	Schlamment-waesserung, insbesondere in der	W76-05820 6B
Apparatus for Collecting Surface Particle on	Papier-, Zellstoff-und Karto	COCIAL IMPACTS
Body of Water, W76-05970 5G	W76-05729 5E	SOCIAL IMPACTS Criteria for Evaluation of Social Impacts of
W76-05970 5G	This Plant Can Use 5 Sludge Processes,	Flood Management Alternatives,
SLIME	W76-05798 5D	W76-05653 6B
Synergistic Compositions Containing 2,2-	Biological Nitrification of Sludge Supernatant	SOCIAL NEEDS
Dibromo-3-Nitrilopropionamide and 3,3,4,4- Tetrachlorotetrahydro-Thiopene-1,1-Dioxide	by Rotating Disks,	Social Science Data Banks and the Institute for
and Their Use,	W76-05800 5D	Water Resources,
W76-05531 5F		W76-05822 6B
SLOPE STABILITY	Sludge Dewatering Trials at Banbury, W76-05809 5D	SOCIAL VALUES
Impact of Clear-Cutting and Road Construction	W 70-03009	A Technique for Environmental Decision Mak-
on Soil Erosion by Landslides in the Western	Method of Reducing Sludge Accumulation	ing Using Quantified Social and Aesthetic
Cascade Range, Oregon.	f T f 1. IV - 4 IV - 4 D	Values.
W76-05614 4C	from Tar Sands Hot Water Process, W76-05965 5D	W76-05825 5G

S

S

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S

SOCIO-CULTURAL SYSTEMS

SOCIO-CULTURAL SYSTEMS	SOIL MCISTURE	SORPTION
Social Impacts of Integrated River Basin	Response of Soil Testacea to Soil Moisture	Removal of Floating Pollutants,
Development on Local Populations,	Fluctuations,	W76-05533 5G
W76-05755 6A	W76-06038 2G	COUNTY OF BOLLING
SOIL	SOIL PHYSICAL PROPERTIES	SOUTH CAROLINA
The Performance of Surface and Sub-Surface	Carbon Dioxide Evolution from Virgin and Cul-	Multi-Objective Water Resources Planning:
Drainage of Heavy Clay Soils in Yugoslavia,	tivated Soil as Affected by Management Prac-	Methodology to Achieve Compatibility
W76-06116 2G	tices and Climate.	Between Environmental Amenities and Economic Development,
W 70-00116 2G	W76-06003 2G	W76-05840 6B
SOIL CHEMICAL PROPERTIES		W 76-03840 6B
Soil Processes and Introduced Chemicals,	SOIL PROFILES	Mirex Residues in Selected Estuaries of South
W76-05936 4C	Salt Transport in Soil Profiles with Application	Carolina: June 1972,
	to Irrigation Return Flow, The Dissolution and	W76-05954 5A
Carbon Dioxide Evolution from Virgin and Cul-	Transport of Gypsum in Soils,	
tivated Soil as Affected by Management Prac-	W76-05836 5B	State V. Griffith (Private Claim to Tidelands).
tices and Climate,	SOIL STABILITY	W76-06087 6E
W76-06003 2G	Soil Stability and Water Yield and Quality,	COUNTY CAROLINA WATER RECOURGES
SOIL CONSERVATION	W76-05937 4D	SOUTH CAROLINA WATER RESOURCES
Fallout CS-137: A Tool in Conservation		COMMISSION South Carolina Scenic Rivers Act of 1974.
Research.	Slope Stability Problems Associated with	
W76-05690 2J	Timber Harvesting in Mountainous Regions of	W76-06090 6E
11.00000	the Western United States,	SOUTH DAKOTA
SOIL CONTAMINATION	W76-05944 4C	Report on Water Quality and Waste-Source In-
Reclamation of Soils Contaminated with	CON TENTUDE	vestigations, Big Sioux River and Selected
Radioactive Strontium,	SOIL TEXTURE	Tributaries.
W76-05906 5G	Evaporation Characteristics of Three Fine-Tex- tured Tarai Soils Under Various Evaporation	W76-05626 5C
	Potentials,	
SOIL EROSION	W76-06037 2D	Geology and Water Resources of Charles Mix
Impact of Clear-Cutting and Road Construction	W 76-06037 2D	and Douglas Counties, South Dakota, Part I:
on Soil Erosion by Landslides in the Western	SOIL TREATMENT	Geology,
Cascade Range, Oregon,	Effect of Surface Applied Sulfuric Acid on	W76-05923 4A
W76-05614 4C	Water Penetration into Dry Calcareous and	0 101
Guidelines for Characterizing Naturally Unsta-	Sodic Soils,	South Dakota Water Pollution Law.
ble or Potentially Unstable Slopes on Western	W76-05907 5G	W76-06074 5G
National Forests,		South Dakota Environmental Policy Act.
W76-05621 4D	Soil Processes and Introduced Chemicals,	W76-06075 5G
	W76-05936 4C	W 70-00075
Slope Stability Problems Associated with	SOIL WATER MOVEMENT	South Dakota Water Quality Standards.
Timber Harvesting in Mountainous Regions of	Spatial Variability of in Situ Unsaturated	W76-06076 5G
the Western United States,	Hydraulic Conductivity of Maddock Sandy	
W76-05944 4C	Loam.	SOUTHERN EVERGLADES (FLA)
A No. of the state of the s	W76-05670 - 2G	Relation of Water Level and Fish Availability
Application of Infrared Spectroscopy to Erodi-		to Wood Stork Reproduction in the Southern
bility Studies of the Soil, W76-06140 2J	Water Movement Within the Root Zone of Ir-	Everglades, Florida,
W76-06140 2J	rigated and Nonirrigated Grain Sorghum,	W76-05850 2I
SOIL GASES	W76-05994 2G	COUPERWEER II C
Carbon Dioxide Evolution from Virgin and Cul-	CON WATER DRECGIRE	SOUTHWEST U.S.
tivated Soil as Affected by Management Prac-	SOIL WATER PRESSURE Spatial Variability of in Situ Unsaturated	Effect of Surface Applied Sulfuric Acid on
tices and Climate,	Hydraulic Conductivity of Maddock Sandy	Water Penetration into Dry Calcareous and Sodic Soils,
W76-06003 2G	Loam,	W76-05907 5G
	W76-05670 2G	11 /3-03-07
SOIL MANAGEMENT		SOVIET UNION (USSR)
Soil Stability and Water Yield and Quality,	SOLAR RADIATION	Status of Water Pollution Control in the Soviet
W76-05937 4D	Method and Apparatus for the Anaerobic	Union,
Geology and Geomorphology of the H. J. An-	Digestion of Decomposable Organic Materials,	W76-05714 5G
	W76-05981 5D	
drews Experimental Forest, Western Cascades, Oregon,	COLID WASTES	SPAIN
W76-05941 4D	SOLID WASTES	Distribution of Lignin in Waters of the Lou-
4D	Water Pollution in Connection with Bark	rizan Inlet as a Measure of Contamination Due
Carbon Dioxide Evolution from Virgin and Cul-	Dumping (Vattenfororeningar i samband med barkdeponering),	to Dumping of Lignosulfonic Liquors Resulting
tivated Soil as Affected by Management Prac-	W76-05726 5B	from Production of Chemical Pulp (La dis-
tices and Climate,	W 70-03720	tribuction de la lignina en aguas de la ensenada
W76-06003 2G	SOLUTES	de lourizan, comomedida de la contaminacion a
SOIL MASS MOURIMENT	Solute Travel-Time Estimates for Tile-Drained	causa del vertido de lejuas ligninsulfonicas,
SOIL MASS MOVEMENT	Fields: I. Theory,	procedentes de la fabricacion de pasta de celu-
The Forest Ecosystem of Southeast Alaska 5.	W76-05904 5B	losa),
Soil Mass Movement,	Colute Translation Paris and Translation	W76-05733 5G
W76-05950 4D	Solute Travel-Time Estimate for Tile-Drained	SPATIAL DISTRIBUTION
SOIL MICROORGANISMS	Fields: II. Application to Experimental Studies, W76-05905 5B	Spatial Dispersion of an Estuarine Benthic Fau-
Soil Microbes,	W76-05905 5B	nal Community,
W76-05935 2G	SORGHUM	W76-06040 2L
20	Detection and Preliminary Identification of En-	26
Effect of Cacodylic Acid and MSMA on	dogenous Antitranspirants in Water-Stressed	SPECIES DIVERSITY
Microbes in Forest Floor and Soil,	Sorghum Plants,	Benthic Invertebrates,
W76-05940 5C	W76-06026 2I	W76-05877 5C

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SPECTRAL ABSORPTION METERS	STATISTICAL STUDIES	CTREASIDED ON I C
A Spectral Light Absorption Meter for Mea-	Statistical Study of the Duckweed Rhizosphere	STREAMBED SILLS Stream Bed Stabilization in Enfield Creek.
surements in the Sea,	as an Eco-Assay Tool,	New York,
W76-05680 7B	W76-05605 5B	W76-06145 8I
and an		CMD II A MARINO
SPECTROMETER Instrumental Method for the Determination of	STATISTICS	STREAMBEDS Stream Bed Stabilization in Enfield Creek,
Trace Elements in Water Samples by Neutron	Statistics of Raingage Data, W76-05693 2B	New York.
Activation Analysis,	W76-05693 2B	W76-06145 8I
W76-05998 5A	STEAM	
	How Steam Is Produced and Handled at the	STREAMFLOW
SPECTROSCOPY	Geysers,	Pine Management Influences the Southern
An Automated Technique for the Sub-Micro-	W76-05574 8C	Water Resource, W76-05616 5B
gram Determination of Selenium and Arsenic in	STEP DRAWDOWN TESTS	W 70-03010
Surface Waters by Atomic Absorption Spec- troscopy,	Pumping-Test Analysis Using a Discrete Time-	The Hydrologic Potential of Unit Areas: A
W76-05736 5A	Discrete Space Numerical Method,	Basis for Managing Water Resources,
311	W76-05913 4B	W76-05620 4D
SPRINGS		Comment Upon Multivariate Synthetic
Bartley V. Sone (Right of Individual to the Use	STOCHASTIC PROCESSES	Hydrology.
of Spring Waters Located Wholly on His Land	A Stochastic Model of Dispersion of Sediment	W76-05909 2A
for Any Purpose).	Particles Released from A Continuous Source,	
W76-06099 6E	W76-05663 2J	Using Parametric Models of Runoff to Improve
SPRINKLER IRRIGATION	Comment Upon Multivariate Synthetic	Parameter Estimates for Stochastic Models, W76-05911 2E
Impact Sprinkler,	Hydrology,	W70-03911 2E
W76-05956 3F	W76-05909 2A	Discharge Equations for HS, H, and HL
		Flumes,
Balanced Sprinkler Impact Drive,	Using Parametric Models of Runoff to Improve	W76-05918 8B
W76-05957 3F	Parameter Estimates for Stochastic Models,	Wind Effects on Stream Flows.
STABILIZATION	W76-05911 2E	W76-05921 2E
Use of Formation Stabilizer - A Valuable	STOMATA	W 76-03921 2E
Technique,	Role of Phenylmercuric Acetate on Stomatal	Harvesting Southern Forests: A Threat to
W76-05564 8A	Regulation and Water Loss in Prosopis	Water Quality,
UII.	Cineraria Linn,	W76-05945 5B
Body Temperature Change Characteristics of	W76-06011 5G	STREAMS
Lake Michigan Fishes,		Relationships Between Drainage Area Charac-
W76-05899 5C	STORAGE COEFFICIENT	teristics and Non-Point Source Nutrients in
STAGE-DISCHARGE RELATIONS	Efficient Wells Save Energy and Reduce Costs,	Streams.
Discharge Equations for HS, H, and HL	W76-05563 4B	W76-05624 5B
Flumes,	Determining Aquifer Coefficients from	41 1322 File of a 1- C-120-1- Co
W76-05918 8B	Residual Drawdown Data,	Algal Nitrogen Fixation in Californian Streams: Seasonal Cycles,
	W76-05689 2F	W76-05639 5C
STANDARD PROJECT FLOOD		W70-05057
Flood Plain Information: Illinois and Michigan	STORM DRAINS	Nucleation Characteristics of Stream Water
Canal, Rock Run Creek, Thorne Creek, Joliet,	Wilber V. Western Properties (Whether an Ar-	and Frazil Ice Nucleation,
Illinois. W76-05645 4A	tificially Altered Watercourse is a Natural or Artificial Channel a Matter of Law).	W76-05695 2C
W76-05645 4A	W76-06103 6E	Limnological Data for the Major Streams in
STANDARDS		Chester County, Pennsylvania,
Thermal Processing and Land Disposal of Solid	STORM RUNOFF	W76-05852 7C
Waste.	Quality and Variation of Pollutant Loads in	
W76-06082 5D	Urban Stormwater Runoff,	Steady-State Segmented Dissolved-Oxygen
CTANDING CROPS	W76-05576 5B	Model, W76-05855 5B
STANDING CROPS	QUURM - A Realistic Urban Runoff Model,	W 70-03833
Effect of Environmental Factors on Standing Crop of Plankton in British Columbia Lakes,	W76-05577 2A	STRENGTH
W76-05741 5C	1170-03577 ZA	Brittle Fracture of Ice at 77 K,
30	Burton V. Douglas County (County Liability	W76-05673 2C
A Note on the Use of Algal Sizes in Estimates	for Flood Damages to Property Caused by	STRESS
of Population Standing Crops,	Faulty Road Construction).	Assessment of a Stressed Macroinvertebrate
W76-06043 5A	W76-06105 6E	Community,
Notes on the Deaduction of Consum Deventure	STORM SEWERS	W76-05636 5C
Notes on the Production of Stream Bryophytes in the High Pyrenees (France),	An Assessment of Automatic Sewer Flow Sam-	
W76-06129 2I	plers - 1975,	STRIP MINE WASTES
21	W76-05864 5D	Precipitation Management for Reclamation of
STARCH		Overgrazed Areas in Arid and Semi-Arid Re-
Environmental Aspects of the Use of Starches	STORM WATER	gions, W76-05603 2B
in the Paper Industry (Hlediska ochrany zivot-	Decision Perspectives on Urban Storm Water	
niho prostredi pri pouzivani skrobovych	Pollution,	Impact of Coal Strip Mining on Water Quality
produktu v papirenskem prumyslu), W76-05720 5B	W76-05509 5D	and Hydrology of East Tennessee,
W76-05720 5B	STREAM FLOW	W76-05833 5B
STATISTICAL METHODS	Shaub V. Fifth Judicial District (Adjudication	STRONTIUM
Correction of Bias in the Estimation of the	of Water Rights in Main Stream Also an Adju-	Studies on the Ca, Mg, and Sr Content of
Coefficient of Skewness,	dication of Rights in Tributaries),	Freshwater Clamshells,
W76-05910 2E	W76-06104 6E	W76-06119 2H

STRONTIUM RADIOISOTOPES

STRONTIUM RADIOISOTOPES	SURFACE RUNOFF	TANZANIA
Reclamation of Soils Contaminated with	Illinois Drainage LawThe Dominant Estate	Breeding Places and Seasonal Incidence of
Radioactive Strontium,	Owner May Not Increase the Rate or Amount	Aedes Aegypti, as Assessed by the Single- Larva Survey Method,
W76-05906 5G	of Surface Water Run-Off onto the Servient Estate Beyond a Range Consistent with a Pol-	W76-06033 5G
SUBLIMATION	icy of Reasonable Use,	170-00033
Sublimation or Melting: Observations from the	W76-06051 4A	TARAI SOILS
White Mountains, California and Nevada,		Evaporation Characteristics of Three Fine-Tex-
U.S.A.,	SURGES	tured Tarai Soils Under Various Evaporation
W76-05683 2C	The Thermal Regime of Trapridge Glacier and	Potentials, W76-06037 2D
	Its Relevance to Glacier Surging, W76-05916 2C	W 76-06037 2D
SUBMERGED LANDS ACT	W76-05916 2C	TARAKIHI
United States V. Florida (Proceeding Seeking Definition of Seaward Boundary of Submerged	SURGING GLACIERS	Food of Tarakihi in Western Bay of Plenty and
Lands of Continental Shelf).	The Thermal Regime of Trapridge Glacier and	Tasman Bay, New Zealand,
W76-06109 6E	Its Relevance to Glacier Surging,	W76-06047 2L
U. To dollo	W76-05916 2C	TASTE
SUBSURFACE DISPOSAL	SURVEYS	Cause and Identification of Taste and Odour
Subsurface Disposal of Liquid Industrial	An Ichthyofaunal Survey and Discussion of	Compounds in Water,
Wastes,	Fish Species Diversity as an Indicator of Water	W76-06009 5A
W76-05573 5B	Quality, Codorus Creek Drainage, York Coun-	TECHNOLOGY
SUBSURFACE HYDROLOGICAL SYSTEMS	ty, Pennsylvania,	Interim Report on the Impact of Public Law 92-
An Identification Approach to Subsurface	W76-05634 5A	500 on Municipal Pollution Control Technolo-
Hydrological Systems,	Wastewater Treatment Evaluation, Mather Air	gy,
W76-05688 2F	Force Base, California,	W76-05867 5D
-	W76-05801 5D	
SUBSURFACE WATERS	11/0/03001	TEMPERATURE
History of Ground Water Concepts,	SUSPENDED SOLIDS	Effect of the Operational Temperature in Reverse Osmosis Method (Gyaku shinto ho ni
W76-05551 2F	Method and Apparatus for Centrifugally	okeru sosa ondo no eikyo),
CUI PIER I IOUODO	Separating Finely Divided Solids from Aqueous	W76-05592 5D
SULFITE LIQUORS	Suspensions Thereof,	11 10 00002
Position of a Calcium Bisulfite Pulp Mill Par-	W76-05543 5D	Influence of Temperature on Biological Purifi-
ticularly with Respect to Intensified Environ- mental Protection Requirements (Die Position	SWARTKOPS ESTUARY (SOUTH AFRICA)	cation of Paper Mill Effluent (Influenza della
einer Kalziumbisulfitfabrik, besonders im Hin-	Notes on the Biology of Some Estuarine	temperatura sulla depurazione biologica di un
blick auf verschaerfte Umweltschutzforderun-	Bivalves,	refluo di cartiera), W76-05700 5D
gen),	W76-06134 2L	W76-05700 5D
W76-05722 5G		Effect of Environmental Factors on Standing
	SWEDEN	Crop of Plankton in British Columbia Lakes,
SULFITE PULP MILLS	Symposium on Water Purification (Symposium over vattenrening),	W76-05741 5C
Position of a Calcium Bisulfite Pulp Mill Par-	W76-05711 5D	Fisheries Research,
ticularly with Respect to Intensified Environ-	11.0 03.11	W76-05878 5C
mental Protection Requirements (Die Position	SYNTHETIC HYDROLOGY	11 70 03070
einer Kalziumbisulfitfabrik, besonders im Hin-	Comment Upon Multivariate Synthetic	Characteristics of Temperature-Sensitive Fish
blick auf verschaerfte Umweltschutzforderun-	Hydrology,	Tags Used in 1974,
gen), W76-05722 5G	W76-05909 2A	W76-05897 5C
W76-05722 5G	Using Parametric Models of Runoff to Improve	Discharge Residence of TLD Tagged Fish,
Reduction of Effluent Volume and Fresh Water	Parameter Estimates for Stochastic Models,	W76-05898 5C
Consumption (Snizhenie ob'ema ctochnykh	W76-05911 2E	
vod i raskhoda svezhej vody),		Body Temperature Change Characteristics of
W76-05727 3E	SYSTEMATICS	Lake Michigan Fishes, W76-05899 50
CHI PURIO I CIR	A Note on the Use of Algal Sizes in Estimates	W76-05899 5C
SULFURIC ACID	of Population Standing Crops, W76-06043 5A	Body Temperatures of Fish Feeding in The
Effect of Surface Applied Sulfuric Acid on Water Penetration into Dry Calcareous and	11 / 3-00043	Point Beach Thermal Discharge,
Sodic Soils,	SYSTEMS ANALYSIS	W76-05900 5C
W76-05907 5G	Systems Approach to River Basin and Inter-	The Thermal Regime of Trapridge Glacier and
30	basin Development,	Its Relevance to Glacier Surging,
SUPERNATANTS	W76-05512 4A	W76-05916 2C
Supernatant Doesn't Have to Ruin Effluent	TACONITE	
Quality,	Reserve Mining Co. V. Environmental Protec-	TENNESSEE
W76-05772 5D	tion Agency (Action by U. S. and Minnesota to	Impact of Coal Strip Mining on Water Quality
SURFACE DRAINAGE	Prevent Discharge of Taconite Tailings into	and Hydrology of East Tennessee, W76-05833 5B
Burton V. Douglas County (County Liability	Water of Lake Superior by Processing Com-	11 (3-0,3633
for Flood Damages to Property Caused by	pany).	TENSION
Faulty Road Construction).	W76-06107 6E	Simple Procedures Can Help Reduce Drill Pipe
W76-06105 6E	TAGGING	Damage,
	Characteristics of Temperature-Sensitive Fish	W76-05572 8C
Butler V. Bruno (Deflection of Surface	Tags Used in 1974,	TERTIARY TREATMENT
Waters)	W76-05897 5C	Energy Requirements for Conventional and
W76-06110 6E		Advanced Wastewater Treatment,
SURFACE-GROUNDWATER RELATIONSHIPS	TANKS	W76-05702 5D
Development and Field Testing of a Basin	Alignment of Longitudinally Aerating Aeration	Andread Control Maria Control
Hydrology Simulator,	Tanks (Naladka aerotankov prodlennoy aerat-	Activated Carbon Treatment of Pulp and Paper
W76-05745 2A	sii), W76-05587	Waste Water,

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Awt Plant is Top Performer,	The Effect of Thermal Discharge on the Rate	TIDAL WATERS
W76-05769 5D	of Accumulation of Organic Substances on Glass Surfaces Immersed in Lake Norman,	
Tertiary Treatment Plant for Multistoried Building,	W76-05875 5C	County, Florida. W76-05647 4A
W76-05789 5D	Zooplankton Entrainment,	TIDAL WETLANDS
	W76-05876 5C	In Re: Marine Equities Corp. V. Biggane (Tidal
Converting Sewage into Savings. W76-05790 5D	Benthic Invertebrates,	Wetland Act Constitutional as Applied to Ap- plication for Permit to Fill Under Water Land
W/0-05/50	W76-05877 5C	Off Staten Island).
Restoring the Quality of Urban Receiving	Fisheries Research.	W76-06100 6E
Waters: Interfacing Upgraded Treatment Facilities with the Stream,	W76-05878 5C	TIDES
W76-05839 5D		Flood Plain Information: Coastal Areas, Levy
	Developments in Underwater Radiotelemetry	County, Florida.
TEST WELLS	and Preliminary Fish Tracking in Thermal	W76-05647 4A
Experimental Well Field is Put to Many Uses, W76-05569 8G	W76-05893 5C	TIME SERIES ANALYSIS
W 70-03303	Commenciation of the Manager of December of	Trend Analysis of Annual Indian Rainfall,
TESTACEA	Comparison of the Movement and Recapture of Salmonid Fishes Tagged at Two Power Plants,	W76-05691 2B
Response of Soil Testacea to Soil Moisture	W76-05894 5C	TISZA RIVER BASIN (HUNGARY)
Fluctuations, W76-06038 2G		Water Resources Development in the Tisza
W 10-00036	Effects of Season, Location, and Discharge Type on Fish Distribution and Density in Ther-	River Basin and Its Impact on Socio-Economic
TEXAS	mal Plumes,	Growth,
Sociological Analysis of Dam Impact: A Study	W76-05896 5C	W76-05519 4A
of Twenty-Two Large Dams in Texas, W76-05501 6B		Long Range Planning of Water Resources: A
W76-05501 6B	THERMAL STRATIFICATION Thermal and Water Quality Characteristics of	Multi Objective Approach,
Coping with Flood Hazard in New Braunfels	Lake Norman,	W76-05760 6A
and Seguin, Texas,	W76-05872 5C	TOXICANTS
W76-05502 6F	Dischar Possissions	Acute Toxicity of a Native Mummichog Popu-
Aquifer Evaluation Using Depositional	Plankton Populations, W76-05873 5C	lation (Fundulus Heteroclitus) to Mercury,
Systems: An Example in North-Central Texas,		W76-05742 5C
W76-05554 2F	THERMAL WATER	TOXICITY
Water's Most Efficient System.	Comparison of the Movement and Recapture of Salmonid Fishes Tagged at Two Power Plants,	Studies on the Effects of Copper on the Lac-
W76-05655 6C	W76-05894 5C	tate Dehydrogenase and Esterase Isozymes in Various Tissues of Carassius Carassius,
		W76-05595 5C
Urban Water Management of an International River: The Case of El Paso -Juarez,	Effects of Season, Location, and Discharge	
W76-05661 3D	Type on Fish Distribution and Density in Ther- mal Plumes,	Antimycin: Beyond Teleocide, W76-05662 5C
	W76-05896 5C	W76-05662 5C
Institutional Constraints and Conjunctive		Comparative Toxicity of Polyelectrolytes to
Management of Water Resources in West Texas.	Discharge Residence of TLD Tagged Fish, W76-05898 5C	Selected Aquatic Animals,
W76-05842 6E	W 70-03898	W76-05740 5C
	Body Temperature Change Characteristics of	Acute Toxicity of a Native Mummichog Popu-
Bartley V. Sone (Right of Individual to the Use	Lake Michigan Fishes, W76-05899 5C	lation (Fundulus Heteroclitus) to Mercury,
of Spring Waters Located Wholly on His Land for Any Purpose).	W 70-03899	W76-05742 5C
W76-06099 6E	Body Temperatures of Fish Feeding in The	Second Annotated Bibliography on Biological
	Point Beach Thermal Discharge,	Effects of Metals in Aquatic Environments,
TEXTILES	W76-05900 5C	W76-05863 SC
Treatment of Dye Wastes With Granular Ac- tivated Carbon,	Growth of Plume Resident Fishes in Lake	Demand for Dissolved Oxygen Exerted by
W76-05738 5D	Michigan,	Finely Divided Logging Debris in Streams,
	W76-05901 5C	W76-05939 4C
THAILAND Views on River Basin Development in Thai-	THERMOREGULATION	Effect of Cacodylic Acid and MSMA on
land,	Body Temperatures of Fish Feeding in The	Microbes in Forest Floor and Soil,
W76-05520 4A	Point Beach Thermal Discharge, W76-05900 5C	W76-05940 5C
***	W 70-03900 SC	Glucuronide Formation in Rainbow Trout: Ef-
THAWING Exploitation of the Waters of Subpermafrost	TIDAL ENERGY	fect of Salicylamide on the Acute Toxicity,
Artesian Basins.	Water Current Power Generator System,	Conjugation and Excretion of 3-
W76-05930 3B	W76-05537 8C	Trifluoromethyl-4-Nitrophenol, W76-06031 5C
THE CEVEEDS (CALLE)	TIDAL MARSHES	
THE GEYSERS (CALIF) How Steam Is Produced and Handled at the	United States V. Lewis (Action to Enjoin Con-	TRACE ELEMENTS
Geysers,	struction of a Causeway across a Tidal Marsh without Permit Required Under the Rivers and	Trace Element, Mineralogy, and Size Distribu- tion of Suspended Material Samples from
W76-05574 8C	Harbors Act).	Selected Rivers in Eastern Kansas,
THERMAL BOLLUTION	W76-06108 6E	W76-05606 5B
THERMAL POLLUTION Environmental Responses to Thermal	TIDAL POWERPLANTS	TBACEBE
Discharges from Marshall Steam Station, Lake	Water Current Power Generator System,	TRACERS Movement of Tracers Through Soil,
Norman, North Carolina,	W76-05537 8C	W76-05701 5B
W76-05870 5C		TDANG MEDITEDDANEAN AGUEDICA
Primary Production,	TIDAL STREAMS Water Current Power Generator System.	TRANS-MEDITERRANEAN AQUEDUCT Proposal for a Trans-Mediterranean Aqueduct,
W76-05874 5C	W76-05537 8C	W76-05660 4A

SUBJECT INDEX

U

U

U

UN

UF

UR

UR

TRANSFER

TRANSFER	Tertiary Treatment Plant for Multistoried	TRITOX
Chemically Enhanced C02 Gas Exchange in a	Building, W76-05789 5D	Limnological Character of Experimental Reser-
Eutrophic Lake: A General Model, W76-05635 5C	W76-05789 5D	voirs Treated with Tritox 30% (DDT, DMDT, GAMMA HCH),
W 70-03633	Edinburgh's Sewage-Treatment and Disposal	W76-06012 5C
TRANSMISSIVITY	Scheme,	1770-0012
Efficient Wells Save Energy and Reduce Costs,	W76-05794 5D	TROPHIC LEVEL
W76-05563 4B	Minimal Cost Plant Cleaning Up Harbor,	A Description of the Trophic Status and
An Identification Approach to Subsurface	W76-05796 5D	Nutrient Loading for Lake George, New York,
Hydrological Systems,	11.0-03770	W76-05638 5C
W76-05688 2F	Automation Can Be Simple,	Distribution of Diatom Frustules in Lake
	W76-05797 5D	Michigan Sediment Cores,
Determining Aquifer Coefficients from	This Plant Con Hour States Processes	W76-05882 5C
Residual Drawdown Data,	This Plant Can Use 5 Sludge Processes, W76-05798 5D	
W76-05689 2F	W 70-03796 3D	TROPICAL CYCLONES
TRANSPIRATION	Wastewater Treatment Evaluation, Mather Air	Effects of a Tropical Cyclone on Littoral and
Eco-Physiological Studies on Desert Plants: IX.	Force Base, California,	Sub-Littoral Biotic Communities and on a
Types of Transpiration Curves of Zilla Spinosa	W76-05801 5D	Population of Dugongs (Dugong Dugon
Prantl Under Natural Conditions,	Wastewater Treatment Evaluation, Mt. Hebo	(Muller)),
W76-06123 2D	Air Force Station, Oregon,	W76-06131 2L
TRAB EFFICIENCY (BECERVOIRC)	W76-05802 5D	TROPICAL RAIN FORESTS
TRAP EFFICIENCY (RESERVOIRS) Reservoir Sedimentation Associated with	11 10 03002	A Non-Adapted Vegetation Interferes with
Catchment Attributes, Landslide Potential,	Port Collection and Separation Facilities for	Water Removal in a Tropical Rain Forest Area
Geologic Faults, and Soil Characteristics,	Oily Wastes. Vol. 5. A Comparative Analysis of	in Hawaii,
W76-05617 4D	Conceptual System Plans for the Surveyed	W76-06042 4A
	Ports Under the 'No Discharge', '1969 Amend-	
TRAPRIDGE GLACIER (YUKON TERR)	ments' and 'No Sheen' Criteria,	TROPICAL REGIONS
The Thermal Regime of Trapridge Glacier and	W76-05830 5D	Surface Energy Budget of Some Climatic
Its Relevance to Glacier Surging,	Interim Report on the Impact of Public Law 92-	Regimes in West Africa, W76-06006 2B
W76-05916 2C	500 on Municipal Pollution Control Technolo-	W76-06006 2B
TREATIES	gy,	TSUNAMIS
Principal Economic Aspects of the Problem of	W76-05867 5D	Conditional Expected Tsunami Inundation for
Salinity of the Colorado River,	al w. a. a	Hawaii,
W76-05821 6E	Clean Water Grant Program.	W76-05920 8B
The American Decree of the Control	W76-06064 5D	
TREATMENT FACILITIES	Nebraska Livestock Waste Control Regula-	TURBIDITY
New System Puts the Wood to Wastewater, W76-05586 5D	tions.	Trace Element, Mineralogy, and Size Distribu- tion of Suspended Material Samples from
W 70-03380	W76-06079 5G	Selected Rivers in Eastern Kansas,
Conversion of a Trickling Filter Plant to Ac-		W76-05606 5B
tivated Sludge,	TREES	70 0000
W76-05588 5D	The Indigenous Trees of the Hawaiian Islands, W76-06005 2I	TURBINES
For Which Load Shall Municipal Purification	W 70-00003	Study of Turbine Mixers for Flow-Through
Plants be Dimensioned. (Fuer Welche	Flood-Caused Tree Mortality Around Illinois	Flocculation Chambers (Vyzkum turbinovych
Belastung Sollen Kommunale Klaeranlagen	Reservoirs,	michadel pro prutocne flokulacni komory),
Bemessen Werden),	W76-06027 4A	W76-05703 5D
	W76-06027 4A	
W76-05609 5D		TURRULENCE
	TREMATODES	TURBULENCE Estimate of the Rate of Turbulent Mixing of
Hydraulic Load Fluctuation in Effluent Treat-	TREMATODES On Diplostomosis of the Grasscarp Fry,	Estimate of the Rate of Turbulent Mixing of
Hydraulic Load Fluctuation in Effluent Treat- ment Plants (Hydraulicke narazy na sedimen-	TREMATODES	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the
Hydraulic Load Fluctuation in Effluent Treat- ment Plants (Hydraulicke narazy na sedimen- tacni cistirny odpadnich vod),	TREMATODES On Diplostomosis of the Grasscarp Fry,	Estimate of the Rate of Turbulent Mixing of
Hydraulic Load Fluctuation in Effluent Treat- ment Plants (Hydraulicke narazy na sedimen-	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt,	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog-
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin)	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog- raphy, W76-05932
Hydraulic Load Fluctuation in Effluent Treat- ment Plants (Hydraulicke narazy na sedimen- tacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant,	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog- raphy, W76-05932 8B TURBULENT FLOW
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin)	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog- raphy, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall,	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog- raphy, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System,	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows,
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog- raphy, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System,	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows,
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation,	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Ir-	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TURBULENT FLOW** Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 **TURBULENT MIXING** Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer,	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation,	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog-
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography,
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D Plant Protects A Recreational Lake,	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photog-
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D Plant Protects A Recreational Lake, W76-05770 5D	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TVERETS RIVER (LATVIAN SSR)
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D Plant Protects A Recreational Lake, W76-05770 5D Regional Plant Treats Septic Wastes,	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D Wastewater Treatment Evaluation, Mt. Hebo	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D Plant Protects A Recreational Lake, W76-05770 5D	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D Wastewater Treatment Evaluation, Mt. Hebo Air Force Station, Oregon,	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TURBULENT FLOW** Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 **B** **TURBULENT MIXING** Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TVERETS RIVER (LATVIAN SSR)* Flood Routing in Channel Systems with Al-
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D Plant Protects A Recreational Lake, W76-05770 5D Regional Plant Treats Septic Wastes,	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D Wastewater Treatment Evaluation, Mt. Hebo	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TURBULENT FLOW** Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 **TURBULENT MIXING** Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TVERETS RIVER* (LATVIAN SSR)* Flood Routing in Channel Systems with Allowance for Bank Regulation, W76-05668 4A
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rchabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D Plant Protects A Recreational Lake, W76-05770 5D Regional Plant Treats Septic Wastes, W76-05771 5D Municipal Plant Handles 44% Pulp and Paper Mill Wastes,	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D Wastewater Treatment Evaluation, Mt. Hebo Air Force Station, Oregon,	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TVERETS RIVER (LATVIAN SSR) Flood Routing in Channel Systems with Allowance for Bank Regulation, W76-05668 4A UKRAINE
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D Plant Protects A Recreational Lake, W76-05770 5D Regional Plant Treats Septic Wastes, W76-05771 5D Municipal Plant Handles 44% Pulp and Paper	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D Wastewater Treatment Evaluation, Mt. Hebo Air Force Station, Oregon, W76-05802 5D TRITIUM Isotopic Study of Hail,	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TVERETS RIVER (LATVIAN SSR) Flood Routing in Channel Systems with Allowance for Bank Regulation, W76-05668 4A UKRAINE Allowance for Precipitation and Runoff Fluc-
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 SD Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 SD Rehabilitating an 80-Year Old Sewer System, W76-05764 SD Brooklyn Plant Meets Major Challenges, W76-05768 SD Awt Plant is Top Performer, W76-05769 SD Plant Protects A Recreational Lake, W76-05770 SD Regional Plant Treats Septic Wastes, W76-05771 SD Municipal Plant Handles 44% Pulp and Paper Mill Wastes, W76-05778 SD	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D Wastewater Treatment Evaluation, Mt. Hebo Air Force Station, Oregon, W76-05802 5D TRITIUM	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TURBULENT FLOW** Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 **TURBULENT MIXING** Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TVERETS RIVER (LATVIAN SSR)* Flood Routing in Channel Systems with Allowance for Bank Regulation, W76-05668 **UKRAINE** Allowance for Precipitation and Runoff Fluctuation Patterns in Computing Water
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 5D Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 5D Rehabilitating an 80-Year Old Sewer System, W76-05764 5D Brooklyn Plant Meets Major Challenges, W76-05768 5D Awt Plant is Top Performer, W76-05769 5D Plant Protects A Recreational Lake, W76-05770 5D Regional Plant Treats Septic Wastes, W76-05771 5D Municipal Plant Handles 44% Pulp and Paper Mill Wastes, W76-05778 5D Toronto's Approach to Preventive Maintenance	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D Wastewater Treatment Evaluation, Mt. Hebo Air Force Station, Oregon, W76-05802 5D TRITIUM Isotopic Study of Hail, W76-05665 2B	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TURBULENT FLOW Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 8B TURBULENT MIXING Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 8B TVERETS RIVER (LATVIAN SSR) Flood Routing in Channel Systems with Allowance for Bank Regulation, W76-05668 4A UKRAINE Allowance for Precipitation and Runoff Fluctuation Patterns in Computing Water Withdrawal for Irrigation Systems in the
Hydraulic Load Fluctuation in Effluent Treatment Plants (Hydraulicke narazy na sedimentacni cistirny odpadnich vod), W76-05699 SD Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant, W76-05706 SD Rehabilitating an 80-Year Old Sewer System, W76-05764 SD Brooklyn Plant Meets Major Challenges, W76-05768 SD Awt Plant is Top Performer, W76-05769 SD Plant Protects A Recreational Lake, W76-05770 SD Regional Plant Treats Septic Wastes, W76-05771 SD Municipal Plant Handles 44% Pulp and Paper Mill Wastes, W76-05778 SD	TREMATODES On Diplostomosis of the Grasscarp Fry, W76-06025 2H On some Problems of the Biological Control of Human Schistosomes in Egypt, W76-06034 5C TREND ANALYSIS Trend Analysis of Annual Indian Rainfall, W76-05691 2B TRICKLE IRRIGATION Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F TRICKLING FILTERS Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D Wastewater Treatment Evaluation, Mt. Hebo Air Force Station, Oregon, W76-05802 5D TRITIUM Isotopic Study of Hail,	Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TURBULENT FLOW** Comparative Estimate of Energy Losses in Bodies of Water, and Quiet and Turbulent Flows, W76-05924 **TURBULENT MIXING** Estimate of the Rate of Turbulent Mixing of the Fluid in Wind-Driven Currents from the Results of Moving and Still Particle Photography, W76-05932 **TVERETS RIVER (LATVIAN SSR)* Flood Routing in Channel Systems with Allowance for Bank Regulation, W76-05668 **UKRAINE** Allowance for Precipitation and Runoff Fluctuation Patterns in Computing Water

Estimate of the Effect of Flood-Plain Drainage on the Annual and Maximum Runoff of Small	URBANIZATION Hanlon Creek Ecological Study, Phase B. W76-05650 6G	Relation of the Consumptive Use Coefficient to the Description of Vegetation,
Rivers in the Ukraine (Dnieper Basin), W76-05676 4A	W76-05650 6G	W76-05843 2D
	Limnological Data for the Major Streams in	Macrovegetation and Ecological Factors in
UNDERGROUND STREAMS Lingo V. City of Jacksonville (Authority of	Chester County, Pennsylvania, W76-05852 7C	Two Norwegian Lakes, W76-06044 5C
City to Pump Subterranean Water). W76-06092 6E	Hydrologic Aspects of Urbanization,	VERTICAL DISTRIBUTION
	W76-05925 4C	The Effect of Oxidized Material on the Vertical
UNITED KINGDOM Management of Environmental Quality: Obser-	Effect of Urbanization on the Quality of River	Distribution of Freshwater Benthic Fauna, W76-05743 5C
vations on Recent Experience in the United	Water, W76-05926 5B	
States and the United Kingdom, W76-05659 5G		VERTICAL PROFILES Vertical Distribution of Nitrate Concentration
W 70-03039	UREAS Effects of Forest Fertilization with Urea on	in Interstitial Water of Marine Sediments with
UNITED STATES	Stream Water Quality-Quilcene Ranger Dis-	Nitrification and Denitrification,
Ground Water is the Only Real Reserve this Country Has.	trict, Washington,	W76-05678 5B
W76-05567 4B	W76-05938 5B	VICTORIA (LAKE WEROWARP)
Ushon Water Management of an International	UREASE INHIBITORS	Seasonal Dynamics and Productivity of Tany-
Urban Water Management of an International River: The Case of El Paso -Juarez,	Control of Nitrogen Transformations in Soils,	tarsus Barbitarsis Freeman (Diptera:Chironomidae) in the Benthos of a
W76-05661 3D	W76-05608 5B	Shallow, Saline Lake,
Principal Economic Aspects of the Problem of	USSR	W76-06142 5C
Salinity of the Colorado River,	Flood Routing in Channel Systems with Al- lowance for Bank Regulation,	VIRGIN ISLANDS
W76-05821 6E	W76-05668 4A	Submerged Lands Legislation Affecting Guam,
The International Law Aspects of the Garrison		The Virgin Islands, and American Samoa (HR
Diversion Project,	Design and Results of Comparative Tests of a Rainfall Recorder Operating for a Week	11559).
W76-06053 6E	(WRR),	W76-06080 6E
Submerged Lands Legislation Affecting Guam,	W76-05674 7B	VIRGINIA
The Virgin Islands, and American Samoa (HR	Allowance for Precipitation and Runoff Fluc-	Flood Hazard Analyses: Buffalo River, Am-
11559).	tuation Patterns in Computing Water	herst County, Virginia. W76-05643
W76-06080 6E	Withdrawal for Irrigation Systems in the	W 10-03043
Outbreaks of Waterborne Disease in the United	Southern Ukraine, W76-05675 4A	Flood Hazard Analyses: Blacks Run-Cooks
States, 1971-1972,		Creek, Rockingham County and Harrisonburg, Virginia.
W76-06138 5C	Estimate of the Effect of Flood-Plain Drainage	W76-05644 4A
UNSATURATED FLOW	on the Annual and Maximum Runoff of Small Rivers in the Ukraine (Dnieper Basin),	
Spatial Variability of in Situ Unsaturated	W76-05676 4A	Modeling the Effect of Waste Discharges in a Small Mountain Stream,
Hydraulic Conductivity of Maddock Sandy Loam,	Slope Runoff and Its Change Under the Effect	W76-05834 5B
W76-05670 2G	of Agricultural and Forest Improvement Prac-	W
	tices,	Vertical Electrical Resistivity Soundings to Locate Ground Water Resources: A Feasibility
Coupled Saturated-Unsaturated Transient Flow in Porous Media: Experimental and Numeric	W76-05927 4C	Study,
Model,	Snow Accumulation and Melting in the Forest	W76-05835 4B
W76-05684 2F	and in Clear-Cut Areas in the Central Ural, W76-05929 2C	Epizootiology of Minchinia Nelsoni in
UNSTEADY FLOW	W /6-03929 2C	Susceptible Wild Oysters in Virginia, 1959 To
Coupled Saturated-Unsaturated Transient Flow	Exploitation of the Waters of Subpermafrost	1971,
in Porous Media: Experimental and Numeric	Artesian Basins, W76-05930 3B	W76-06035 5C
Model, W76-05684 2F		VIRUSES
W 70-05004	UTAH Utah Water Pollution Control Act.	Outbreaks of Waterborne Disease in the United
Normal Mode Analysis of the Linear Equation	W76-06077 5G	States, 1971-1972, W76-06138 5C
of Groundwater Flow, W76-05685 2F	III I D. C. W I C I D	
	Utah Definitions and General Requirements. W76-06078 5G	VISTULA RIVER BASIN (POLAND)
URBAN HYDROLOGY		A Case Study Report on the Vistula River
Decision Perspectives on Urban Storm Water Pollution.	UTTAR PRADISH (INDIA) Water Resources Development in the Ganga-	Basin, W76-05514 4A
W76-05509 5D	Ghagra Interbasin in Uttar Pradesh (India),	VOLCANOES
UBBAN BUNGEE	W76-05763 4A	VOLCANOES Table of Data on Water Quality of Baker Lake
URBAN RUNOFF Quality and Variation of Pollutant Loads in	VARIETIES	near Mount Baker, Washington,
Urban Stormwater Runoff,	An Ichthyofaunal Survey and Discussion of	W76-05857 7C
W76-05576 5B	Fish Species Diversity as an Indicator of Water	VOLTA LAKE (GHANA)
Hydrologic Aspects of Urbanization,	Quality, Codorus Creek Drainage, York Coun- ty, Pennsylvania,	Dynamics of Benthic Invertebrates in a Tropi-
W76-05925 4C	W76-05634 5A	cal Man Made Lake (Volta Lake 1964-1968):
URBAN WATER RESOURCES	VEGETATION	Standing Crop and Bathymetric Distribution, W76-06144 5C
Restoring the Quality of Urban Receiving	Guidelines for Characterizing Naturally Unsta-	17 /0-00144 SC
Waters: Interfacing Upgraded Treatment	ble or Potentially Unstable Slopes on Western	VYREDOX METHOD
Facilities with the Stream, W76-05839 5D	National Forests, W76-05621 4D	Vyredox-In Situ Purification of Ground Water, W76-05553 5F
W76-05839 5D	W76-05621 4D	# 70°03333

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SUBJECT INDEX

VYREDOX METHOD

•		
Examination and Removal of Iron in Ground- water,	Deposit of Motor Vehicle Bodies and Accessories into the Waters of the State.	Liquid Purifying Process, W76-05528 5D
W76-05571 5B	W76-06070 5G	Inhibition of Scale Deposition.
WADING BIRDS Relation of Water Level and Fish Availability	Thermal Processing and Land Disposal of Solid Waste.	W76-05529 5D
to Wood Stork Reproduction in the Southern Everglades, Florida,	W76-06082 5D	Bio Pond Aerator, W76-05535 5D
W76-05850 2I	WASTE DISPOSAL (LAND)	To all the Delevie and the Philipped Calife
	Thermal Processing and Land Disposal of Solid Waste.	Leaching Polyelectrolyte Fluidized Solids, W76-05536 5D
WARNING SYSTEMS Benefit and Cost Analysis of Hydrological	W76-06082 5D	W 70-03330
Forecasts.		Process for Biochemical Reactions,
W76-05823 6B	WASTE DISPOSAL WELLS Subsurface Disposal of Liquid Industrial	W76-05542 5D
	Wastes,	Method and Apparatus for Centrifugally
WASHINGTON The Impact of Timber Harvest, Fertilization,	W76-05573 5B	Separating Finely Divided Solids from Aqueous Suspensions Thereof,
and Herbicide Treatment on Streamwater	WASTE TREATMENT	W76-05543 5D
Quality in Western Oregon and Washington,	Industrial Cost Recovery and User Charge As-	
W76-05618 5B	sessments,	Process for Conditioning Effluent Con-
Table of Data on Water Quality of Baker Lake	W76-05813 5G	taminated by Aldehyde Compounds, W76-05545 5D
near Mount Baker, Washington,	Regulations Pertaining to Waste Discharge Per-	11 10-03343
W76-05857 7C	mits.	Filtering Apparatus and Process,
Some Observations on the Behavior of the	W76-06069 5G	W76-05546 5D
Liquid and Gas Phases in Temperate Glacier Ice,	South Dakota Water Pollution Law. W76-06074 5G	Process for Treating Waste Water Containing Cellulose Nitrate Particles,
W76-05915 2C		W76-05575 5D
	Environmental Protection AgencyPoultry	
Effects of Forest Fertilization with Urea on	Processing Products, Proposed Performance and Pretreatment Standards.	Wastewater Treatment,
Stream Water QualityQuilcene Ranger Dis- trict, Washington,	W76-06096 5G	W76-05579 5D
W76-05938 5B		Waste Water and Sewage Treatment.
	WASTE TREATMENT/STREAM	W76-05580 5D
Distribution and Structure of Benthic Assem-	INTERFACING Restoring the Quality of Urban Receiving	Submerged Air Release Device Particularly for
blages in Puget Sound, Washington, USA, W76-06015	Waters: Interfacing Upgraded Treatment	Sewage Treatment,
W76-06015 5B	Facilities with the Stream,	W76-05581 5D
The Washington Shoreline Management Act,	W76-05839 5D	
W76-06056 5G	WASTE WATER DISPOSAL	Sewage Treatment, W76-05582 5D
Wilber V. Western Properties (Whether an Ar-	Optimal Groundwater Quality Management:	W 70-03382
tificially Altered Watercourse is a Natural or Artificial Channel a Matter of Law).	Well Injection of Waste Waters, W76-05507 5B	Carbon Wastewater Treatment Process. W76-05583 5D
W76-06103 6E		
	Subsurface Disposal of Liquid Industrial Wastes,	Cathodic Inner and Outer Protection for a Dou- ble Syphon for Waste Water (Kathodischer
Burton V. Douglas County (County Liability	W76-05573 5B	Innen-und Aussenschutz Fuer Einen Abwasser-
for Flood Damages to Property Caused by Faulty Road Construction).		Doppeldueker),
W76-06105 6E	Design, Operation, and Monitoring of Mu- nicipal Irrigation Systems,	W76-05584 5D
	W76-05783 SE	Chemical Precipitation of Wastewaters with
WASHINGTON SHORELINE MANAGEMENT		Lime (Kemisk fallning av avloppsvatten med
ACT The Washington Shoreline Management Act,	Michigan Wastewater Reporting and Surveil- lance Fees Rules.	kalk),
W76-06056 5G	W76-06067 5G	W76-05585 5D
		New System Puts the Wood to Wastewater,
WASTE ASSIMILATIVE CAPACITY	Regulations Pertaining to Waste Discharge Per- mits.	W76-05586 5D
Efficiency in Water Quality Control for the Willamette River.	W76-06069 5G	Alignment of Longitudinally Agrating Assetion
W76-05658 5G		Alignment of Longitudinally Aerating Aeration Tanks (Naladka aerotankov prodlennoy aerat
	South Dakota Water Quality Standards.	sii),
WASTE DISPOSAL Protecting Groundwater from Landfill	W76-06076 5G	W76-05587 5D
Protecting Groundwater from Landfill Leachate,	Utah Definitions and General Requirements.	Conversion of a Trickling Filter Plant to Ac-
W76-05599 5G	W76-06078 5G	tivated Sludge, W76-05588 5E
Water Pollution in Connection with Bark	WASTE WATER (POLLUTION) Automated Dilution for Measurement of	
Dumping (Vattenfororeningar i samband med barkdeponering).	Nitrate in Water,	Removal of Ammonia Nitrogen by Catalytic Oxidation Filter Bed (Sesshoku sanka rosho n
W76-05726 5B	W76-05594 5A	yoru ammonia-set chisso no jokyo),
Incineration's Role is Ultimate Discussion	WASTE WATER TREATMENT	W76-05589 5E
Incineration's Role in Ultimate Disposal of Process Wastes,	Method of Biological Purification of Sewage,	Technical-Economic Product Design as
W76-05791 5E	W76-05524 5D	Typified by a Sewage Pumping Installation,
	Biodegradation of Methanolic Waste Water,	W76-05591 5E
Process for the Treatment of Mineral Slimes, W76-05973 5D	W76-05525 5D	Effect of the Operational Temperature in
11.10-03713	Buffered, Weak Ion-Exchange Water	Reverse Osmosis Method (Gyaku shinto ho n
Waste Discharge Reports and Requirements.	Demineralization Process,	okeru sosa ondo no eikyo),
W76-06065 5G	W76-05526 3A	W76-05592 5E

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How Does Tank Geometry Affect the Oxygen	Biological Treatment by a System of Activated	Pond and Irrigation Systems Offer Economy
Transfer Rate of Mechanical Surface Aerators. W76-05593 5D	Sludge Applied to the Effluent Waters of a Corrugated Board Plant,	Pond and Irrigation Systems Offer Economy and Flexibility, W76-05774 5D
Street Analyzors are for Waste as Well as	W76-05713 5D	Phosphorus Removal from Static Sewage Ef-
Stream Analyzers are for Waste as Well as Product,	Experimental Study of the Purification of Ef-	fluent Using Duckweed,
W76-05596 5A	fluents from the Manufacture of Bleached Bisulfite Pulp by Aeration Lagooning (Etude	W76-05775 5D
Lime-Induced Reactions in Municipal Waste- waters.	experimentale de l'epuration par lagunage aere de liqueurs bisulfitiques de pate de cellulose	Process Biodegradable Effluent Underground. W76-05776 5D
W76-05597 5D	blanchie), W76-05718 5D	Wastewater Renovation and Reuse: An Urgen
Optimal Design Model for Waste Water Collec- tion System (II) (Gesuidokan kiyo keikaiu no	Bleach Plant Pollution Abatement Where Do	Environmental Need, W76-05777 5D
saitekika moderu to sono oyo (II)), W76-05598 5D	We Stand, W76-05719 5D	Toronto's Approach to Preventive Maintenance
For Which Load Shall Municipal Purification	Purification of Waste Waters at the Kraft Mill	for Treatment Plants, W76-05780 5F
Plants be Dimensioned. (Fuer Welche	of 'La Cellulose Des Ardennes' (Epuration des eaux residuaires a La Cellulose des Ardennes),	Operational Practices to Upgrade Trickling
Belastung Sollen Kommunale Klaeranlagen Bemessen Werden),	W76-05721 5D	Filter Plant Performance, W76-05781 5D
W76-05609 5D	Escher-Wyss Flotation Cells for Clarification and Cleaning (Die Escher-Wyss Flotationszel-	Anaerobic Digestion: The Rate-Limiting
Nomograms for Simplified Hydraulic Dimen- sioning of Waste Water Ducts (Nomogramme	len zur Klaerung und Reinigung), W76-05723 5D	Process and the Nature of Inhibition, W76-05784 5D
Zur Vereinfachten Hydraulischen Bemessung Von Abwasser-Kanaelen),	Optimizing Organic Carbon and Color Removal	Lime Recovery and Reuse in Primary Treat
W76-05610 5D	from a Board Mill Effluent, W76-05724 5D	ment, W76-05785 SE
Processing of Sediments from Coagulation Ap-		
plied as the Third Stage of Effluent Purification (Przerabianie osadow powstajacych przy	Activated Carbon Treatment of Pulp and Paper Waste Water,	Low Cost Phosphorous Removal, W76-05786 5E
zastosowaniu koagulacji jako trzeciego stopnia	W76-05730 5D	Combined Waste Treatment Proves Economi-
oczyszczania sciekow z przemysłu włokiennic- zego),	Silver in Photoprocessing Effluents, W76-05732 5D	cal and Feasible, W76-05787 SE
W76-05697 5D	Purification of Gum Rosin Producing Plant Ef-	
Use of Ion Exchangers and Synthetic Sorbents for Removal of Color from Kraft Process ef-	fluents from Resinous Substances (Ochistka stochnykh vod kanifol'noterpentinnogo proiz-	Cross-Flow Filtration and Axial Filtration, W76-05788 5D
fluents (Proby zastosowania jonitow i sor- bentow syntetycznych do usuwania barwy ze	vodstva ot smolistykh veshchestv), W76-05735 5D	Tertiary Treatment Plant for Multistoried Building,
sciekow posiarczanosych), W76-05698 5D	Biological Treatment of Dyes,	W76-05789 SE
Hydraulic Load Fluctuation in Effluent Treat-	W76-05737 5D	Converting Sewage into Savings. W76-05790 5E
ment Plants (Hydraulicke narazy na sedimen- tacni cistirny odpadnich vod),	Treatment of Dye Wastes With Granular Ac- tivated Carbon, W76-05738 5D	Biological Denitrification and its Application in
W76-05699 5D	Rehabilitating an 80-Year Old Sewer System,	Treatment of High-Nitrate Waste Water, W76-05792 5E
Influence of Temperature on Biological Purifi-	W76-05764 5D	Quebec's Water and Sewage Masterplan for
cation of Paper Mill Effluent (Influenza della temperatura sulla depurazione biologica di un	Plastic Pipe, Pressure Sewers, Mark Expan-	Mirabel Region. W76-05793 5E
refluo di cartiera),	sion, W76-05765 5D	
W76-05700 5D	Water Purified by Electroflotation for Rapid	Edinburgh's Sewage-Treatment and Disposa Scheme,
Energy Requirements for Conventional and Advanced Wastewater Treatment,	Sedimentation and Clean Clarified Water. W76-05766 5D	W76-05794 SE
W76-05702 5D		Factors in the Purification of Flowing Sewage and Activated Sludge Process, Part I,
Study of Turbine Mixers for Flow-Through Flocculation Chambers (Vyzkum turbinovych	Flotation Process and Apparatus. W76-05767 5D	W76-05795 SE
michadel pro prutocne flokulacni komory), W76-05703 5D	Brooklyn Plant Meets Major Challenges, W76-05768 5D	Minimal Cost Plant Cleaning Up Harbor, W76-05796 51
Super Teamwork gives Green Bay (Wisconsin)	Awt Plant is Top Performer,	Automation Can Be Simple, W76-05797 SI
a Super Waste Treatment Plant, W76-05706 5D	W76-05769 5D	This Plant Can Use 5 Sludge Processes,
Lab-Proven Fly Ash Process Removes Bleach	Plant Protects A Recreational Lake, W76-05770 5D	W76-05798 5E
Effluent Color, W76-05707 5D	Regional Plant Treats Septic Wastes, W76-05771 5D	Aerated Lagoons Solve Town's Site Problems, W76-05799
Electrolytic Coagulation of Lignin from Kraft	Supernatant Doesn't Have to Ruin Effluent	Biological Nitrification of Sludge Supernatan
Will Dleagh Dleast Western to	Quality,	by Rotating Disks,
	W76-05772 SD	W76-03800 SI
Mill Bleach Plant Wastewaters, W76-05708 5D Symposium on Water Purification (Symposium	W76-05772 5D Municipal Wastewater Odor Still a Problem	W76-05800 SE Wastewater Treatment Evaluation, Mather Ai

SUBJECT INDEX

WASTE WATER TREATMENT

Wastewater Treatment Evaluation, Mt. Hebo	Method of Reducing Sludge Accumulation	WATER ANALYSIS
Air Force Station, Oregon, W76-05802 5D	from Tar Sands Hot Water Process, W76-05965 5D	Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh
An Evaluation of the Use of Gamma Radiation	Method of Extracting Heavy Metals from In-	vod), W76-05705 5A
in Sewage Treatment, W76-05803 5D	dustrial Waste Waters, W76-05966 5D	Analysis of Pulp and Paper Mill Waste Waters by High-Resolution Ion-Exchange Chromatog-
Removal of Detergent Fluorescent Whitening Agents from Waste Water,	Apparatus for the Treatment of Liquid Wastes, W76-05967 5D	raphy, W76-05709 5A
W76-05804 5D	Sewage Treatment System,	Book Bhotochomical Basemanities of On
Process in Mathods of Nitrata Removal	W76-05969 5D	Rapid Photochemical Decomposition of Or- ganic Mercury Compounds in Natural Water,
Progress in Methods of Nitrate Removal, W76-05805 5D	Method for the Primary and Secondary Treat-	W76-05715 5A
Nitrate Removal from Water by Ion Exchange, W76-05806 5F	ment of Wastewater in a Unitary Apparatus, W76-05972 5D	Removal of Copper and Iron Prior to Water Hardness Titration,
Engineers Can Exert Process Control Over	Process for the Treatment of Mineral Slimes, W76-05973 5D	W76-05716 5A Extraction - Visible Spectrophotometric
Digester Inputs,	Files Charles Mathed	Method for Determination of Nitrate: Applica-
W76-05807 5D	Filter Cleaning Method, W76-05974 5F	tion to Water Analysis,
Sludge Dewatering Trials at Banbury,		W76-05717 5A
W76-05809 5D	Multi-Tank Ion Exchange Water Treatment System,	A Coulometric Device for Measuring Total Ox-
An Economic Model of Water Use and Waste	W76-05975 5F	ygen Demand, W76-05728 5A
Treatment,	Dissolved Air Floatation System,	
W76-05814 5D	W76-05976 5D	An Automated Technique for the Sub-Micro- gram Determination of Selenium and Arsenic in
Port Collection and Separation Facilities for	Method and Apparatus for the Anaerobic	Surface Waters by Atomic Absorption Spec-
Oily Wastes. Vol. 5. A Comparative Analysis of	Digestion of Decomposable Organic Materials,	troscopy,
Conceptual System Plans for the Surveyed Ports Under the 'No Discharge', '1969 Amend-	W76-05981 5D	W76-05736 5A
ments' and 'No Sheen' Criteria,	Purification of Waste Water Containing Phthal-	Hydrogeochemical Data from Investigation of
W76-05830 5D	ic Esters, W76-05982 5D	Water Quality in Sewered and Unsewered Areas, Southern Nassau County, Long Island,
Design and Operation of High-Rate Filters		New York,
Part 2, W76-05831 5D	Method of Treatment of Sludges With Size-Ad- justed Carbon,	W76-05858 7C
170-03031	W76-05985 5D	WATER BALANCE
Design and Operation of High-Rate Filters- Part 3,	Method for Removing Soluble Selenium from	Climatic Water Balance at Hissar, W76-06041 2B
W76-05832 5F	Acidic Waste Water, W76-05986 5D	WATER CHEMISTRY
Restoring the Quality of Urban Receiving	Sewage Treatment and Recycling System,	Aquifer Evaluation Using Depositional Systems: An Example in North-Central Texas,
Waters: Interfacing Upgraded Treatment Facilities with the Stream,	W76-05988 5D	W76-05554 2F
W76-05839 5D	Flocculation Apparatus,	Chemistry of Mud-Water Interface in an Im-
Interim Report on the Impact of Public Law 92-	W76-05989 5F	poundment, W76-05630 5C
500 on Municipal Pollution Control Technolo-	Reverse Osmosis Separation Apparatus, W76-05990 3A	
gy. W76-05867 5D	W76-05990 3A	WATER CONSERVATION Proceedings - Conference on Water Conserva-
	Apparatus for the Separation of Liquid Mix-	tion and Sewage Flow Reduction with Water-
Lime Use in Wastewater Treatment: Design and Cost Data,	tures My Means of Permeability Selective Separation Membranes,	Saving Devices. W76-05602 5D
W76-05868 5D	W76-05991 3A	
P	WASTES	Reduction of Effluent Volume and Fresh Water
Process and Equipment for Automatic Chemi- cal-Biological Wastewater Treatment with	Hydraulic Load Fluctuation in Effluent Treat-	Consumption (Snizhenie ob'ema ctochnykh vod i raskhoda svezhej vody),
Provisions for Recycle and Reuse,	ment Plants (Hydraulicke narazy na sedimen- tacni cistirny odpadnich vod),	W76-05727 3E
W76-05955 5D	W76-05699 5D	South Carolina Scenic Rivers Act of 1974.
Evaporator-Condenser Unit for Producing	Steady-State Segmented Dissolved-Oxygen	W76-06090 6E
Potable Water From Sewage, W76-05960 5D	Model,	WATER CONVEYANCE
	W76-05855 5B	Flowmeter for an Open Aqueduct, W76-05540 7B
Wastewater Treatment, W76-05961 5D	WASTEWATER TREATMENT Biomass Distribution and Kinetics of Baffled	WATER COSTS
Ion Exchanger for the Treatment of Waste	Lagoons,	Water's Most Efficient System.
Water,	W76-05590 5D	W76-05655 6C
W76-05962 5D	WATDOC	WATER DEMAND
Method of Treating Waste Liquids from Photo-	Canadian Water Resources Information: A	Supply and Demand in Water Planning:
graphic Processings,	Network Approach, W76-05952 10D	Streamflow Estimation and Conservational Water Pricing,
W76-05963 5D		W76-05607 6D
Process for Separating Oil from Emulsions of	WATER ALLOCATION (POLIGY)	
Oil in Water,	The Out-Of-Kilter Algorithm and Some of its Applications in Water Resources.	Water and Its Role in the World (Wasser und was es in der Welt damit auf sich hat),
W76-05964 5D	W76-05515 6A	W76-05739 6D

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6D

The Master Plan for Water Supply in the Re-	Long Range Planning of Water Resources: A	Synergistic Compositions Containing 2.2-
gional Municipality of Ottawa-Carleton,	Multi Objective Approach,	Dibromo-3-Nitrilopropionamide and 3,3,4,4-
W76-05815 6D	W76-05760 6A	Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use,
An Economic Analysis of Water Use in	The Washington Shoreline Management Act,	W76-05531 5F
Colorado's Economy, W76-05837 6B	W76-06056 5G	Assessing for the Collection of Burnet
W 70-03637	WATER MANAGEMENT (POLICY)	Apparatus for the Collection of Buoyant Foreign Matter,
WATER DISTRIBUTION	Goals and Forms of Co-operation Among	W76-05534 5G
Ground Water is the Only Real Reserve this	Countries for the Development of International	
Country Has. W76-05567 4B	River Basins, W76-05521 4A	A Study of Prospective Water Pollution Con- trol Activities for the Ohio River Valley Water
A Rural Mississippi Success Story: Alcorn	WATER PERMITS	Sanitation Commission (Orsanco), W76-05654 5G
County's Water System.	Waste Discharge Reports and Requirements.	W76-05654 5G
W76-05657 6D	W76-06065 5G	Effluent Discharge Law-Burdens and Con-
WATER DISTRIBUTION (APPLIED)	WATER POLICY	sequences for the Paper Industry
Water Line,	The Safe Drinking Water Act of 1974: A	(Abwasserabgabengesetz-Belastungen und Fol- gerungen fuer die Papierindustrie),
W76-05541. 3F	Management Impact Statement.	W76-05712 5G
Water's Most Efficient System.	W76-05656 5G	
W76-05655 6C	Patrician in Water Outlier Control for the	Status of Water Pollution Control in the Soviet
	Efficiency in Water Quality Control for the Willamette River,	Union, W76-05714 5G
Proposal for a Trans-Mediterranean Aqueduct,	W76-05658 5G	W 70-03714
W76-05660 4A		Position of a Calcium Bisulfite Pulp Mill Par-
WATER INTERCHANGE	Urban Water Management of an International	ticularly with Respect to Intensified Environ-
Regional Water Exchange for Drought Allevia-	River: The Case of El Paso -Juarez, W76-05661 3D	mental Protection Requirements (Die Position
tion,	W/6-03061 3D	einer Kalziumbisulfitfabrik, besonders im Hin- blick auf verschaerfte Umweltschutzforderun-
W76-05819 4A	International River Basin Cooperation: Some	gen),
WATER LAW	Factors Influencing Agreement,	W76-05722 5G
Institutional Constraints and Conjunctive	W76-05758 6E	
Management of Water Resources in West	WATER POLLUTION	Distribution of Lignin in Waters of the Lou- rizan Inlet as a Measure of Contamination Due
Texas,	Quality and Variation of Pollutant Loads in	to Dumping of Lignosulfonic Liquors Resulting
W76-05842 6E	Urban Stormwater Runoff,	from Production of Chemical Pulp (La dis-
WATER LEVEL FLUCTUATIONS	W76-05576 5B	tribuction de la lignina en aguas de la ensenada
Water Level Gauge,	Management of Environmental Quality: Obser-	de lourizan, comomedida de la contaminacion a
W76-05977 7B	vations on Recent Experience in the United	causa del vertido de lejuas ligninsulfonicas,
WATER LEVEL RECORDERS	States and the United Kingdom,	procedentes de la fabricacion de pasta de celu- losa),
Water Level Gauge,	W76-05659 5G	W76-05733 5G
W76-05977 7B	Water Pollution in Connection with Bark	
WATER LEVELS	Dumping (Vattenfororeningar i samband med	Quebec's Water and Sewage Masterplan for
Forecasting Water Levels in Aquifers by Nu-	barkdeponering),	Mirabel Region. W76-05793 5D
merical and Semihybrid Methods,	W76-05726 5B	
W76-05686 2F	Evaluation of Quality Parameters in Water	Sewer Flow Measurement - A State-Of-The-Art
Water Level Gauge,	Resource Planning: A State-of-the-Art Survey	Assessment, W76-05865 5D
W76-05977 7B	of the Economics of Water Quality,	W 70-03803
	W76-05818 5G	Impacts of Hydrologic Modification on Water
WATER MANAGEMENT (APPLIED)	The Chemical Speciation of PU-239, PU-240	Quality,
A Case Study Report on the Vistula River Basin,	and CS-137 in Lake Michigan Waters,	W76-05866 5G
W76-05514 4A	W76-05889 · 5B	The Economics of Clean Water. Volume III.
	Apparatus for Collecting Surface Particle on	Industry Expenditures for Water Pollution
Water Resources Development in the Tisza River Basin and Its Impact on Socio-Economic	Body of Water,	Abatement.
Growth,	W76-05970 5G	W76-05951 5G
W76-05519 4A		Method of Reducing Sludge Accumulation
Charletonian of Mark 1 4 C	Recovering Bitumen from Large Water Sur- faces.	from Tar Sands Hot Water Process,
Classification of Methods of Groundwater Management (Klassificaksiiya metodov	W76-05992 5G	W76-05965 5D
upravleniya rezhimom i resursami podzemnykh		Removal of Immiscible Fluids from Water Sur-
vod),	Alaska Oil Pollution Regulations.	faces and Lake Beds,
W76-05600 4B	W76-06062 5G	W76-05984 5G
Urban Water Management of an International	Designation and Determination of Removability	Corps Issues Interim Rules for Discharges of
River: The Case of El Paso -Juarez,	of Hazardous Substances from Water.	Dredged and Fill Materials.
W76-05661 3D	W76-06084 5G	W76-06061 5G
Water Management Control System for the	WATER POLLUTION CONTROL	State Water Quality Control Frank
Water Management Control System for the Zagyva-Tarna River Basin,	Decision Perspectives on Urban Storm Water	State Water Quality Control Fund. W76-06063 5G
W76-05746 4A	Pollution,	11,7500003
	W76-05509 5D	Waste Discharge Reports and Requirements.
Legal Framework of Co-Operation in the Field of Water Management Between Hungary and	Recent Trends in Water Quality Management	W76-06065 5G
Her Neighboring Countries,	and Protection in Hungary,	Michigan Water Resources Commission Act.
W76-05759 6E	W76-05518 5G	W76-06068 5G

SUBJECT INDEX

WATER POLLUTION CONTROL

State Financial Assistance to Public Agencies	Methods and Apparatus for Treating Waste-	Water-Resources Investigations of the U.S.
for Pollution Control Facilities.	water,	Geological Survey in the Northern Great Plains
W76-06073 50	W76-05987 5D	Coal Region of Eastern Montana, 1975-76, W76-05853
Utah Water Pollution Control Act.	Recovering Bitumen from Large Water Sur-	
W76-06077 50	faces, W76-05992 5G	Table of Data on Water Quality of Baker Lake near Mount Baker, Washington,
Plastics and Synthetics Point Source Category		W76-05857 7C
(Proposed Effluent Limitations and		
Guidelines). W76-06086 50	W76-06064 5D	Hydrogeochemical Data from Investigation of
W /6-00086	WATER PURIFICATION	Water Quality in Sewered and Unsewered Areas, Southern Nassau County, Long Island,
WATER POLLUTION EFFECTS	Pollution Control System for Water Supply,	New York,
Development of Oxygen Deficits in 1-	W76-05530 5F	W76-05858 7C
Southern Ontario Lakes,	Hea of Balumania Quaternam Ammonium	
W76-05679 50	Use of Polymeric Quaternary Ammonium Betaines as Water Clarifiers,	Geohydrology of the Evangeline and Jasper
Sensitivity of Blood Cell Counts in Juvenile	W76-05544 5F	Aquifers of Southwestern Louisiana, W76-05861 2F
Coho Salmon (Oncorhynchus Kisutch) to Stres		1170 0000
sors Including Sublethal Concentrations of Pul Mill Effluent and Zinc.		Availability of Ground Water in the Androscog-
W76-05696 50	W76-05547 5F	gin River Basin, Northern New Hampshire,
1170-05050	Water Purification Apparatus and Timing	W76-05862 7C
Effect of Bleached Kraft Mill Effluent on the		Environmental Responses to Thermal
Survival of Starved Juvenile Coho Salmon	W76-05968 5F	Discharges from Marshall Steam Station, Lake
(Oncorhynchus Kisutch), W76-05710 50	Method of Preventing Scale From Being	Norman, North Carolina,
W 70-03710	Deposited In Case of Producing Fresh Water	W76-05870 5C
Second Annotated Bibliography on Biologica		Thermal and Water Quality Characteristics of
Effects of Metals in Aquatic Environments,	W76-05971 3A	Lake Norman,
W76-05863 50	Multi-Tank Ion Exchange Water Treatment	W76-05872 5C
Contamination of Freshwater by Mn54 and		
Co60,	W76-05975 5F	Solute Travel-Time Estimates for Tile-Drained
W76-05903 56		Fields: I. Theory, W76-05904 5B
Williams V. Duka Barras Co. (Silting of Street	Multistage Flash Evaporator for Producing Soft	W 70-03904 3B
Williams V. Duke Power Co. (Silting of Stream Ponds, and Lake).	Water from a Saline Water, W76-05978 3A	Solute Travel-Time Estimate for Tile-Drained
W76-06088 61		Fields: II. Application to Experimental Studies,
	Method and Apparatus for Desalinization of	W76-05905 5B
WATER POLLUTION SOURCES	Water,	Effect of Urbanization on the Quality of River
Control of Nitrogen Transformations in Soils, W76-05608	W76-05979 3A	Water,
W 70-03000	WATER QUALITY	W76-05926 5B
Report on Water Quality and Waste-Source In		C-11 C-1 114 1 W-1- Vi-14 1 C II
vestigations, Big Sioux River and Selecter		Soil Stability and Water Yield and Quality, W76-05937 4D
Tributaries. W76-05626 56	W76-05612 5C	W 70-03937 4D
W76-05626 56	Pine Management Influences the Southern	Effects of Forest Fertilization with Urea on
Environmental Aspects of the Use of Starche		Stream Water QualityQuilcene Ranger Dis-
in the Paper Industry (Hlediska ochrany zivot		trict, Washington, W76-05938 5B
niho prostredi pri pouzivani skrobovyc	The Impact of Timber Harvest, Fertilization,	W76-05938 5B
produktu v papirenskem prumyslu), W76-05720 51		Timber Production and Water Quality
11.0 03.20	Quality in Western Oregon and Washington,	Progress in Planning for the Bull Run, Portland,
Chemical Characterization of Fiber Buildin	W76-05618 5B	Oregon's Municipal Watershed,
Board Mill Effluent,	D	W76-05942 5B
W76-05731 57	Report on Water Quality and Waste-Source Investigations, Big Sioux River and Selected	Impact of Forest Fertilization on Water Quality
Silver in Photoprocessing Effluents,	Tributaries.	in the Douglas-Fir Region A Summary of
W76-05732 5I		Monitoring Studies,
Transfer of Lindane from Bark of Insecticide	How to Guide Growth in Southeastern New	W76-05943 5B
Sprayed Pine Pulpwood into Effluent from		Harvesting Southern Forests: A Threat to
Barking Drum (Lindaanin huuhtoutumisest	W76-05649 6G	Water Quality,
suojaruiskutetun mantykuitupuun kuorest		W76-05945 5B
rumpukuorimon jateveteen), W76-05734	Perspective 75. W76-05651 6B	WATER QUALITY CONTROL
W76-05734 5I	W76-05651 6B	Optimal Groundwater Quality Management:
WATER POLLUTION TREATMENT	Evaluation of Quality Parameters in Water	Well Injection of Waste Waters,
Process and Equipment for Automatic Chemi		W76-05507 5B
cal-Biological Wastewater Treatment with		Detection Devices for Use in Solution
Provisions for Recycle and Reuse, W76-05955		Processing Systems,
	Selected Water-Quality Data from Fallen Leaf	W76-05532 5F
Removal of Immiscible Fluids from Water Sur		
faces and Lake Beds,	through October 1974,	Water Treating Apparatus, W76-05547 5F
W76-05984 50	W76-05848 7C	W76-05547 5F
Method of Treatment of Sludges With Size-Ad		Efficiency in Water Quality Control for the
justed Carbon,	Chester County, Pennsylvania,	Willamette River,
W76-05985 5I	W76-05852 7C	W76-05658 5G

.S. ins 7C ake 7C

of red nd,

7C
per
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cog7C
mal
ake
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stion 5F 5F the

5G

Restoring the Quality of Urban Receiving	Goals and Forms of Co-operation Among	Lime Recovery and Reuse in Primary Treat-
Waters: Interfacing Upgraded Treatment Facilities with the Stream,	Countries for the Development of International River Basins,	ment, W76-05785
W76-05839 5D	W76-05521 4A	
Removal of Immiscible Fluids from Water Sur-	Inter Basin Transfer of Water Resource Case	Sewage Treatment and Recycling System, W76-05988 5E
faces and Lake Beds,	Study of Indus Project, W76-05753 4A	WATER RIGHT
W76-05984 5G	W /0-03/33 4A	Institutional Constraints and Conjunctive
State Water Quality Control Fund.	Simulation as a Tool in International River	Management of Water Resources in Wes
W76-06063 5G	Development, W76-05757 6A	Texas, W76-05842
Michigan Water Resources Commission Act.	A Boutfolio American to Bublic Water Busines	WATER CAMBITAC
W76-06068 5G	A Portfolio Approach to Public Water Project Decision Making,	WATER SAMPLING Portable Water Sampling Apparatus,
South Dakota Water Pollution Law.	W76-05995 6B	W76-05958 71
W76-06074 5G	WATER RESOURCES DEVELOPMENT	Apparatus for Collecting Surface Particle or
Hack Definitions and Consul Beautiers and	Water Resources Development in the Tisza	Body of Water,
Utah Definitions and General Requirements. W76-06078 5G	River Basin and Its Impact on Socio-Economic	W76-05970 50
	Growth, W76-05519 4A	WATER-SAVING DEVICES
WATER QUALITY MANAGEMENT	P 5 6 1 W 6	Proceedings - Conference on Water Conserva
Structuring Communications Programs for Public Participation in Water Resources	Proceedings - Conference on Water Conserva- tion and Sewage Flow Reduction with Water-	tion and Sewage Flow Reduction with Water Saving Devices.
Planning,	Saving Devices.	W76-05602 51
W76-05652 6B	W76-05602 5D	WATER SOFTENING
WATER QUALITY STANDARD	A Rural Mississippi Success Story: Alcorn	Detection Devices for Use in Solution
South Dakota Water Pollution Law.	County's Water System.	Processing Systems,
W76-06074 5G	W76-05657 6D	W76-05532
WATER QUALITY STANDARDS	Proposal for a Trans-Mediterranean Aqueduct,	Water Treating Apparatus,
The Safe Drinking Water Act of 1974: A	W76-05660 4A	W76-05547 51
Management Impact Statement.	Real-Time Management of Water-Resource	Multistage Flash Evaporator for Producing Sof
W76-05656 5G	Systems,	Water from a Saline Water,
Certification of Conformance with Water	W76-05747 6A	W76-05978 32
Quality Standards.	The Czechoslovak Water Development	Method of Operating Ion Exchange System,
W76-06066 5G	Planning Approach and Its Application, W76-05749 6A	W76-05983
Regulations Pertaining to Waste Discharge Per-		WATER SOURCES
mits.	The Columbia Basin Project Reappraised, W76-05750 4A	Ground Water is the Only Real Reserve thi
W76-06069 5G	W76-05750 4A	Country Has. W76-05567 4i
South Dakota Water Quality Standards.	Water Resources Development in the Ganga-	
W76-06076 5G	Ghagra Interbasin in Uttar Pradesh (India), W76-05763 4A	WATER SUPPLY Water Resources Development in the Tisz
Utah Water Pollution Control Act.		River Basin and Its Impact on Socio-Economi
W76-06077 5G	Social Impact Assessment: An Analytic Bibliography,	Growth,
Nebraska Livestock Waste Control Regula-	W76-05820 6B	W76-05519 4/
tions.	Application of Multi-Regional Planning Models	Minimizing the Operating and Capital Costs of
W76-96079 5G	to the Scheduling of Large-Scale Water	Water Supply Projects, W76-05522 6/
Environmental Protection AgencyPoultry	Resource Systems Development,	
Processing Products, Proposed Performance	W76-05846 6A	Classification of Methods of Groundwate Management (Klassificaksiiya metodo
and Pretreatment Standards.	A Digital-Computer Model for Estimating	upravleniya rezhimom i resursami podzemnyk
W76-06096 5G	Hydrologic Changes in the Aquifer System in Dane County, Wisconsin,	vod),
Water Quality Standards: Oregon (Withdrawal	W76-05851 2F	W76-05600 41
of Proposed Rule Making).	Water December Investigations of the II-C	Supply and Demand in Water Planning
W76-06098 5G	Water-Resources Investigations of the U.S. Geological Survey in the Northern Great Plains	Streamflow Estimation and Conservations Water Pricing.
WATER RESOURCES	Coal Region of Eastern Montana, 1975-76,	W76-05607 6I
Uncertainty in Water Resources Decision Mak-	W76-05853 7C	How to Guide Growth in Southeastern New
ing, W76-05513 6A	Northern Great Plains Resource Program.	England, Parts I, II and IV of the Draft Report
	W76-06050 6D	W76-05649 60
The Out-Of-Kilter Algorithm and Some of its Applications in Water Resources,	WATER REUSE	Perspective 75.
W76-05515 6A	Proceedings - Conference on Water Conserva- tion and Sewage Flow Reduction with Water-	W76-05651 61
A Review of Some Hydrological Studies	Saving Devices.	Water's Most Efficient System.
Required in the Design of Water Management	W76-05602 5D	W76-05655 60
Projects.	Wastewater Renovation and Reuse:An Urgent	A Rural Mississippi Success Story: Alcorn
W76-05517 4A	Environmental Need,	County's Water System.
Views on River Basin Development in Thai-	W76-05777 5D	W76-05657 6I
land,	Water Factory 21 is the Future,	Proposal for a Trans-Mediterranean Aqueduct,
W76-05520 4A	W76-05782 5F	W76-05660 4A

SUBJECT INDEX

WATER SUPPLY

Water and Its Role in the World (Wasser und		WATER WELL DRILLING FORMS
was es in der Welt damit auf sich hat), W76-05739 6D	ment, W76-05785 5D	Records and Drilling Reports. W76-05557 6A
Reverse Osmosis Plant Helps City Cope with Diminishing Groundwater Supply, W76-05779 5F	W76-05805 5D	WATER WELLS History of Ground Water Development, W76-05556 4B
	Nitrate Removal from Water by Ion Exchange,	46
Water Factory 21 is the Future, W76-05782 5F		Efficient Wells Save Energy and Reduce Costs, W76-05563 4B
The Master Plan for Water Supply in the Re-	Old Slow Sand + New Rapid Filtration - Sedi-	Use of Formation Stabilizer - A Valuable
gional Municipality of Ottawa-Carleton, W76-05815 6D	W76-05808 SF	Technique,
1 D' 10 Will (D.)	Design and Operation of High-Rate Filters	W76-05564 8A
A Digital-Computer Model for Estimating Hydrologic Changes in the Aquifer System in Dane County, Wisconsin,	Don't 2	Experimental Well Field is Put to Many Uses, W76-05569 8G
W76-05851 2F	n i lo i i i i i i i i i i i i i i i i i	The state of the Water of Colombia
	Design and Operation of High-Rate Filters Part 3.	Exploitation of the Waters of Subpermafrost Artesian Basins.
Groundwater Study of a Volcanic Area Near	W76-05832 5F	W76-05930 3B
Bandung, Java, Indonesia, W76-05914 4B		
WATER TABLE	Effect of Municipal Treatment Processes on PU-239, PU-240, and CS-137,	Portable Water Sampling Apparatus, W76-05958 7B
Effective Use of High Water Table Areas for		1.0 0.000
Sanitary Landfill. Vol. II,		WATER WORKS
W76-05744 5G	Desalination Apparatus,	The Master Plan for Water Supply in the Re-
Effect of Dooth and Solinity of County Water	W76-05959 3A	gional Municipality of Ottawa-Carleton, W76-05815 6D
Effect of Depth and Salinity of Ground Water on Evaporation and Soil Salinization,	Water Purification Apparatus and Timing	W 76-03813
W76-06036 2D		WATER YIELD
	W76-05968 5F	Pine Management Influences the Southern
WATER TABLE AQUIFERS	Method of Preventing Scale From Being	Water Resource,
Northern Great Plains Resource Program. W76-06050 6D		W76-05616 5B
	From Sea Water,	Soil Stability and Water Yield and Quality,
WATER TRANSFER Evaluation of the Effects of Water Transfer,	W76-05971 3A	W76-05937 4D
W76-05751 6A	Filter Cleaning Method,	Harvesting Southern Forests: A Threat to
	W76-05974 5F	Water Quality,
Regional Water Exchange for Drought Allevia tion,		W76-05945 5B
W76-05819 4A	Multi-Tank Ion Exchange Water Treatment System,	WATER YIELD IMPROVEMENT
	W76-05975 SF	Yukon City's New Well Replaces Five Older
Water and Phosphate Transport to Plant Roots, W76-06002		Ones,
	Flocculation Apparatus, W76-05989 5F	W76-05566 4B
WATER TREATMENT	W 70-03989	WATERBORNE DISEASES
Pollution Control System for Water Supply, W76-05530 5F	Reverse Osmosis Separation Apparatus,	Outbreaks of Waterborne Disease in the United
W76-05530 SI	W76-05990 3A	States, 1971-1972,
Synergistic Compositions Containing 2,2		W76-06138 5C
Dibromo-3-Nitrilopropionamide and 3,3,4,4	tures My Means of Permeability Selective	WATERCOURSES (LEGAL ASPECTS)
Tetrachlorotetrahydro-Thiopene-1,1-Dioxide and Their Use,	Separation Membranes,	Wilber V. Western Properties (Whether an Ar-
W76-05531 5F	W76-05991 3A	tificially Altered Watercourse is a Natural or
	WATER USE REDUCTION	Artificial Channel a Matter of Law).
Detection Devices for Use in Solution Processing Systems.	Proceedings - Conference on Water Conserva-	W76-06103 6E
W76-05532 5E	tion and Sewage Flow Reduction with Water-	WATERSHED (BASINS)
	Saving Devices.	Plutonium Concentrations in Water and
Bio Pond Aerator,	W76-05602 5D	Suspended Sediment from the Miami River
W76-05535 5I	WATER USERS	Watershed, Ohio, W76-05887 5B
Water Treating Apparatus,	Oliver V. Hyle (Termination of Water and	W /6-0388/
W76-05547 51		WATERSHED MANAGEMENT
Vyredox-In Situ Purification of Ground Water,	Denial of Due Process).	The Hydrologic Potential of Unit Areas: A
W76-05553 51	W76-06094 6E	Basis for Managing Water Resources, W76-05620 4D
Water Clarification Cambridge	WATER UTILIZATION	W76-05620 4D
Water Clarification Settler. W76-05578	An Economic Model of Water Use and Waste	Hanlon Creek Ecological Study, Phase B.
	Was assis	W76-05650 6G
Reverse Osmosis Plant Helps City Cope with	W76-05814 5D	A Study of Prospective Water Pollution Con-
Diminishing Groundwater Supply, W76-05779 51	An Economic Analysis of Water Use in	trol Activities for the Ohio River Valley Water
	Colorado's Economy,	Sanitation Commission (Orsanco),
Toronto's Approach to Preventive Maintenance	W76-05837 6B	W76-05654 5G
for Treatment Plants, W76-05780 51	WATER VAPOR	Geology and Geomorphology of the H. J. An-
	Method and Apparatus for Desalinization of	drews Experimental Forest, Western Cascades,
Water Factory 21 is the Future,	Water,	Oregon,
W76-05782 51	W76-05979 3A	W76-05941 4D

Impact of Forest Fertilization on Water Quality	WILD RIVER ACT
in the Douglas-Fir Region A Summary of Monitoring Studies,	South Carolina Scenic Rivers Act of 1974. W76-06090 6E
W76-05943 5B	W 70-00090
11.003713	WILDLIFE
The International Law Aspects of the Garrison	The Impact of Canyon Dam and Reservoir on
Diversion Project,	Wildlife,
W76-06053 6E	W76-05504 6G
WATERSHEDS (BASINS)	WILLAMETTE RIVER (OR)
Miami River Watershed Project: Introduction,	Efficiency in Water Quality Control for the
W76-05886 5B	Willamette River.
	W76-05658 5G
Factors Influencing Infiltration and Sediment	
Production of Semiarid Rangelands in Nevada,	WIND STRESS
W76-05912 2G	Wind Effects on Stream Flows,
Timber Production and Water Quality	W76-05921 2E
Progress in Planning for the Bull Run, Portland,	WINDS
Oregon's Municipal Watershed,	Wind Effects on Stream Flows,
W76-05942 5B	W76-05921 2E

WAVELENGTHS	WISCONSIN
Finite Element Mesh Gradation for Surface	Super Teamwork gives Green Bay (Wisconsin)
Waves,	a Super Waste Treatment Plant,
W76-05919 8E	W76-05706 5D
WAVES (WATER)	A Digital-Computer Model for Estimating
Apparatus and Method for Extracting Wave	Hydrologic Changes in the Aquifer System in
Energy,	Dane County, Wisconsin,
W76-05538 8C	W76-05851 21
11 70-05550	W 70-03031
Wave-Action Power Apparatus,	Studies on the Ca, Mg, and Sr Content of
W76-05549 8C	Freshwater Clamshells,
	W76-06119 2H
Estimate of the Rate of Turbulent Mixing of	
the Fluid in Wind-Driven Currents from the	WITHDRAWAL
Results of Moving and Still Particle Photog-	Allowance for Precipitation and Runoff Fluc
raphy, W76-05932 8B	tuation Patterns in Computing Wate Withdrawal for Irrigation Systems in the
W 70-03932 6B	Southern Ukraine.
WEATHER MODIFICATION	W76-05675 4A
Field Observations of the Persistence of AgI-	W 76-03073
NH4I-Acetone Ice Nuclei in Daylight,	WOOD STORKS
W76-05677 3B	Relation of Water Level and Fish Availability
	to Wood Stork Reproduction in the Southern
WELL SCREENS	Everglades, Florida,
Colorado City Solves its Sand Pumping	W76-05850 2
Problems,	WOOD WARRE
W76-05559 8C	WOOD WASTES
Proper Selection of Gravel Pack is Key to Suc-	Demand for Dissolved Oxygen Exerted by
cessful Wells.	Finely Divided Logging Debris in Streams, W76-05939 46
W76-05565 8C	W 76-03939 40
	YEASTS
WESTERN CASCADES (ORE)	Yeasts Isolated from Some Lakes and River
Geology and Geomorphology of the H. J. An-	of Saskatchewan,
drews Experimental Forest, Western Cascades,	W76-06135 51
Oregon,	
W76-05941 4D	ZAGYVA-TARNA RIVER BASIN (HUNGARY)
WET SEASONS	Water Management Control System for th
Surface Energy Budget of Some Climatic	Zagyva-Tarna River Basin,
Regimes in West Africa,	W76-05746
W76-06006 2B	ZILLA-SPINOSA
1170 00000	Eco-Physiological Studies on Desert Plants: IX
WETLANDS	Types of Transpiration Curves of Zilla Spinos
In Re: Marine Equities Corp. V. Biggane (Tidal	Prantl Under Natural Conditions,
Wetland Act Constitutional as Applied to Ap-	W76-06123 21
plication for Permit to Fill Under Water Land	
Off Staten Island).	ZINC
W76-06100 6E	Sensitivity of Blood Cell Counts in Juvenil
WHITE MOUNTAINS (NEV AND CALIF)	Coho Salmon (Oncorhynchus Kisutch) to Stres
Sublimation or Melting: Observations from the	sors Including Sublethal Concentrations of Pul
White Mountains, California and Nevada,	Mill Effluent and Zinc, W76-05696 56
U.S.A.,	# /0°03090
W76-05683 2C	ZOOPLANKTON
	Zooplankton Entrainment,
WILD AND SCENIC RIVERS ACT	W76-05876 50
To Amend the Wild and Scenic Rivers Act (on	
S. 10 and S. 1004).	1
W76-06081 6E	

6A

4B osts, 4B nable

frost 3B

7B Re-6D

thern 5B

4D t to 5B

AB nited SC

Ar-

and River
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ss: A
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Anades,

4D

AD I AD I a

AB

AD S S V

AD

AK

AK

AL

ALI C S iz

ALI O P. W

ALI P W AM S U

AUTHOR INDEX

ABEL, J. F.	ANDERSON, H. W.	AYERS, R. R.
Finite Element Mesh Gradation for Surface	The Hydrologic Potential of Unit Areas: A	Removal of Floating Pollutants,
Waves,	Basis for Managing Water Resources,	W76-05533 5G
W76-05919 8E	W76-05620 4D	
The state of the s		BACK, E. L.
ADAIR, W. D.	Reservoir Sedimentation Associated with	Chemical Characterization of Fiber Building
Thermal and Water Quality Characteristics of	Catchment Attributes, Landslide Potential,	Board Mill Effluent,
Lake Norman,	Geologic Faults, and Soil Characteristics,	W76-05731 5A
W76-05872 5C	W76-05617 4D	
		BACKUS, E.
ADAMS, G. F.	ANDERSON, W. R. JR.	Minimal Cost Plant Cleaning Up Harbor,
Emory Oak (Quercus Emoryi) Litter Phenolics	Analysis of Pulp and Paper Mill Waste Waters	W76-05796 5D
as Environmental Hazards for Aquatic Animals	by High-Resolution Ion-Exchange Chromatog-	
in Southeastern Arizona,	raphy,	BAILLIE, R. A.
W76-06125 5B	W76-05709 5A	Method of Reducing Sludge Accumulation
***************************************	Wild Golds	from Tar Sands Hot Water Process,
ADAMS, R. C.	ANDREWS, J. D.	W76-05965 5D
Method of Operating Ion Exchange System,	Epizootiology of Minchinia Nelsoni in	W 10-03903
W76-05983 5F	Susceptible Wild Oysters in Virginia, 1959 To	BAKHSHI, N. N.
***	1971,	Lab-Proven Fly Ash Process Removes Bleach
ADAMS, S. N.		
Some Relations Between Forest Litter and	W76-06035 5C	Effluent Color,
Growth of Sitka Spruce on Poorly Drained	ANDREWS, J. T.	W76-05707 5D
Soils,		BATROON B W
	Collapse of the Hudson Bay Ice Center and	BALDOCK, E. H.
W76-05687 2I	Glacio-Isostatic Rebound,	Toronto's Approach to Preventive Maintenance
ADAMS, W. M.	W76-05669 2C	for Treatment Plants,
		W76-05780 51
Conditional Expected Tsunami Inundation for	ANGERILLI, P. D. C.	23000000
Hawaii,	Influences of Some Freshwater Plants on the	BALLO, I. Z.
W76-05920 8B	Development and Survival of Mosquito Larvae	Water Resources Development in the Tisza
. WHILE DO LESS TO A	in British Columbia,	River Basin and Its Impact on Socio-Economic
AKHMEDSAFIN, U. M.	W76-06048 5G	Growth,
Classification of Methods of Groundwater		W76-05519 4A
Management (Klassificaksiiya metodov	ANGINO, E. E.	17 10 000 17
upravleniya rezhimom i resursami podzemnykh	Trace Element, Mineralogy, and Size Distribu-	BANDYOPADHYA, A. K.
vod),	tion of Suspended Material Samples from	Studies on Depth and Quality of Water on Soi
W76-05600 4B	Selected Rivers in Eastern Kansas,	Salinization: Behaviour of Anions in the Soi
AKIM, G. L.	W76-05606 5B	Profile with Reference to the Position of Water
Reduction of Effluent Volume and Fresh Water	ANIDY AV D	Table,
Consumption (Snizhenie ob'ema ctochnykh	ANIELAK, P.	W76-06141 20
vod i raskhoda svezhej vody),	Use of Ion Exchangers and Synthetic Sorbents	
W76-05727 3E	for Removal of Color from Kraft Process ef-	BARBA, D.
W. C.	fluents (Proby zastosowania jonitow i sor-	Multistage Flash Evaporator for Producing Sof
ALBERTS, J. J.	bentow syntetycznych do usuwania barwy ze	Water from a Saline Water,
The Chemical Speciation of PU-239, PU-240	sciekow posiarczanosych),	W76-05978 3A
and CS-137 in Lake Michigan Waters,	W76-05698 5D	
W76-05889 5B		BARD, C. C.
W 10-03883	ANTONIONI, MARY ELLEN	Silver in Photoprocessing Effluents,
Effect of Municipal Treatment Processes on	Antimycin: Beyond Teleocide,	W76-05732 5I
PU-239, PU-240, and CS-137,	W76-05662 5C	
		BARKER, W. H. JR.
W76-05890 5F	ARIKAWA, Y.	Outbreaks of Waterborne Disease in the United
Sedimentary Pu-239, Pu-240 Phase Distribu-	Method of Preventing Scale From Being	States, 1971-1972,
	Deposited In Case of Producing Fresh Water	W76-06138 50
tions in Lake Michigan Sediments,	From Sea Water,	1770 00150
W76-05891 5B		BARTELT, G. E.
	W76-05971 3A	Plutonium Concentrations in Water and
ALESINA, I. G.	ARN, E.	
Control of Coagulant Recovery from Effluent		Suspended Sediment from the Miami River
Sediment (Kontrol' regeneratsii koagulyantov	Technical-Economic Product Design as	Watershed, Ohio, W76-05887 SE
iz osadka ctochnykh vod),	Typified by a Sewage Pumping Installation,	W/6-0388/
W76-05725 SE	W76-05591 5D	Distances in Assertic Dieto of the Court Mines
	* W.W. * T. Y. * **	Plutonium in Aquatic Biota of the Great Miam
ALFARO, A.	ARTALE, J. V.	River Watershed, Ohio,
Rehabilitating an 80-Year Old Sewer System,	Rehabilitating an 80-Year Old Sewer System,	W76-05888 5C
W76-05764 5D	W76-05764 5D	DARKS W
		BARUS, V.
ALLEN, R. M.	ATKINSON, E. S.	On some Problems of the Biological Control of
Occurrence of Phytophthora Species and Other	Bleach Plant Pollution Abatement Where Do	Human Schistosomes in Egypt,
Potential Plant Pathogens in Recycled Irrigation	We Stand,	W76-06034 5C
Water,	W76-05719 5D	
W76-06010 5C		Some Helminths of Bulinus Truncatus and
	AUROY, M.	Biomphalaria Alexandrina from the Irrigation
ALLEY, E. R.	Purification of Waste Water Containing Phthal-	System Near Cairo,
	ic Esters,	W76-06028 5A
Plant Protects A Recreational Lake.		
Plant Protects A Recreational Lake, W76-05770 5D	W /0-03982	
Plant Protects A Recreational Lake, W76-05770 5D	W76-05982 5D	BATANOUNY, K. H.
W76-05770 5D AMBERG, H. R.	AYERS, F. E.	Eco-Physiological Studies on Desert Plants: IX
W76-05770 5D AMBERG, H. R. Status of Water Pollution Control in the Soviet	AYERS, F. E. The Master Plan for Water Supply in the Re-	Eco-Physiological Studies on Desert Plants: IX Types of Transpiration Curves of Zilla Spinosa
W76-05770 5D AMBERG, H. R.	AYERS, F. E.	Eco-Physiological Studies on Desert Plants: IX

В

B

B

B

B

B

B

B

B

BI

BATTEKE, J. P. H. Canadian Water Resources Information: A Network Approach, W76-05952 10D	Productivity and Biochemical Composition of Chlorella at Different Levels of Illumination and Nitrogen Limitation, W76-05640 5C	BISHOP, A. B. Structuring Communications Programs for Public Participation in Water Resources Planning, W76-05652 6B
BAUER, A.	11 10 03010	
Spatial Variability of in Situ Unsaturated Hydraulic Conductivity of Maddock Sandy Loam,	BENFIELD, E. F. Eutrophic Gradient in Smith Mountain Lake, Virginia,	BLACKBURN, T. R. Mercury in Sediments of the Horwer Buch (Lake Lucerne) and Tributary Streams, Swit- zerland.
W76-05670 2G	W76-05627 5C	W76-06136 5A
BAUER, D. P. Steady-State Segmented Dissolved-Oxygen Model, W76-05855 SB	BENJAMIN, C. T. Sewage Treatment and Recycling System, W76-05988 5D	BLACKBURN, W. H. Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada,
	BENNER, R.	W76-05912 2G
BAUMANN, D. D. Coping with Flood Hazard in New Braunfels and Seguin, Texas, W76-05502 6F	The Taking Issue: Potential Obstacle to natural Resource Management Legislation, W76-06055 6E	BOBEE, B. Correction of Bias in the Estimation of the Coefficient of Skewness,
W 70-03302	BERGSTROM, G. I.	W76-05910 2E
BAUMANN, P. C. Lake Wingra, 1837-1973: A Case History of Human Impact,	Effective Use of High Water Table Areas for Sanitary Landfill. Vol. II, W76-05744 5G	BOEHLER, T. Subtidal Marine Biology of California, with
W76-05997 5C		Emphasis on the South,
BEAR, J.	BERMAN, T. Phosphorus, Nitrogen, and the Growth of	W76-06023 2L BOGARDI, I.
Forecasting Water Levels in Aquifers by Nu- merical and Semihybrid Methods,	Algae in Lake Kinneret, W76-05633 5C	Uncertainty in Water Resources Decision Mak-
W76-05686 2F		ing,
	BERTINE, K. K.	W76-05513 6A
BEATY, C. B. Sublimation or Melting: Observations from the	The Deposition of Molybdenum in Anoxic Waters,	воіко, к.
White Mountains, California and Nevada, U.S.A.,	W76-05996 2K	Super Teamwork gives Green Bay (Wisconsin) a Super Waste Treatment Plant,
W76-05683 2C	BERWART, G.	W76-05706 5D
BEBIN, J. L.	Purification of Waste Waters at the Kraft Mill of 'La Cellulose Des Ardennes' (Epuration des	BOKHARI, S. M. H.
Method of Biological Purification of Sewage, W76-05524 5D	eaux residuaires a La Cellulose des Ardennes), W76-05721 5D	Ex-Post Evaluation of River Basin Develop- ments in Pakistan, W76-05748 6A
BECHAC, J. P.	BEWERS, J. M.	DOLLEN W D
Evaluation of Surface Water Pollution at Several Points in Relation to Zones of Shellfish Industry in Roadsteads of the Brest Region, (In	Trace Metals in the Waters of the Gulf of St. Lawrence, W76-06024 5A	BOLLEN, W. B. Effect of Cacodylic Acid and MSMA or Microbes in Forest Floor and Soil, W76-05940 50
French), W76-06150 5B	BHUTANI, J.	
	Impacts of Hydrologic Modification on Water	Soil Microbes, W76-05935 2G
BEIRNE, P. Influences of Some Freshwater Plants on the	Quality, W76-05866 5G	BOLT, B. A.
Development and Survival of Mosquito Larvae in British Columbia,	BIESINGER, K. E.	Seismic Instrumentation of Dams, W76-05667 8D
W76-06048 5G	Comparative Toxicity of Polyelectrolytes to Selected Aquatic Animals,	BONHOTE, P. A.
BEITINGER, T. L.	W76-05740 5C	An Evaluation of the Use of Gamma Radiation
Body Temperature Change Characteristics of Lake Michigan Fishes,	BIGNAZZI, R.	in Sewage Treatment, W76-05803 5D
W76-05899 5C	Influence of Temperature on Biological Purifi- cation of Paper Mill Effluent (Influenza della	BOOTH, R. B.
BELASCO, I. J. Biodegradation of Methanolic Waste Water,	temperatura sulla depurazione biologica di un refluo di cartiera).	Leaching Polyelectrolyte Fluidized Solids, W76-05536 5D
W76-05525 5D	W76-05700 5D	W 76-03336
		BOOTH, S. J.
BELL, D. T. Flood-Caused Tree Mortality Around Illinois Reservoirs,	BILLEN, G. Vertical Distribution of Nitrate Concentration in Interstitial Water of Marine Sediments with	Pumping-Test Analysis Using a Discrete Time Discrete Space Numerical Method, W76-05913 44
W76-06027 4A	Nitrification and Denitrification, W76-05678 5B	BORTHWICK, P. W.
BELL, J. M.	W76-05678 5B	Mirex Residues in Selected Estuaries of South
Detergent Phosphate Ban Yields Little Phosphorus Reduction, Part I,	BINSON, B. Views on River Basin Development in Thai-	Carolina: June 1972, W76-05954 5A
W76-05637 5C	land,	BORTLESON, G. C.
BELLINGER, E. G. A Note on the Use of Algal Sizes in Estimates	W76-05520 4A BIRO, K.	Table of Data on Water Quality of Baker Lake near Mount Baker, Washington,
of Population Standing Crops, W76-06043 5A	Nematodes of Lake Balaton: IV. Seasonal Qualitative and Quantitative Changes,	W76-05857 70
BELUCHE, R. A.	W76-06004 5C	BOVET, E. D. Evaluation of Quality Parameters in Wate
Effective Use of High Water Table Areas for Sanitary Landfill. Vol. II,	BISHNOI, O. P. Climatic Water Balance at Hissar,	Resource Planning: A State-of-the-Art Survey of the Economics of Water Quality,
W76-05744 5G	W76-06041 2B	W76-05818 50

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BD

on 5D

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BOWERS, D. M.	BROWN, H. R.	CAMINADA, R.
Operational Practices to Upgrade Trickling	An Automated Technique for the Sub-Micro-	Influence of Temperature on Biological Purifi-
Filter Plant Performance,	gram Determination of Selenium and Arsenic in	cation of Paper Mill Effluent (Influenza della
W76-05781 5D	Surface Waters by Atomic Absorption Spec-	temperatura sulla depurazione biologica di un
POWLING I I	troscopy, W76-05736 5A	refluo di cartiera),
BOWLING, J. L. Determination of Selenium in Natural Waters	W76-05736 5A	W76-05700 5D
Using the Centrifugal Photometric Analyzer,	BROWN, P.	CANELLI, E.
W76-06128 2K	Costs as a Guide to Pricing,	Effects of Salinity on Nitrification in the East
11/0 00120	W76-05570 6C	River,
BRADLEY, R. S.	BROWN, R. E.	W76-05631 5C
Equilibrium-Line Altitudes, Mass Balance, and	Plan Formulation and Evaluation Studies-	
July Freezing-Level Heights in the Canadian	Recreation. Vol. II of V. Estimating Initial	CAREY, D. I.
High Arctic,	Reservoir Recreation Use,	Supply and Demand in Water Planning:
W76-05682 2C	W76-05611 6B	Streamflow Estimation and Conservational
BRADY, D. K.		Water Pricing, W76-05607 6D
Introduction and Physical Description of Lake	BRUSADIN, G.	W 70-03007
Norman,	Water Line, W76-05541 3F	Using Parametric Models of Runoff to Improve
W76-05871 5C	W 70-03341	Parameter Estimates for Stochastic Models,
	BUEHLER, B.	W76-05911 2E
Thermal and Water Quality Characteristics of	Monetary Values of Life and Health.	CARLOON C. M.
Lake Norman,	W76-05812 6F	CARLSON, C. T.
W76-05872 5C	PURCHELL C	Lake and Shore Ice Conditions on Southeast-
NR ANDRO M	BURCHELL, C. An Evaluation of Some Recreational, Demo-	ern Lake Michigan in the Vicinity of the Donald C. Cook Nuclear Plant: Winter 1973-74,
BRANDES, M.	graphic and Economic Impacts of Canyon	W76-05664 2C
Movement of Tracers Through Soil,	Lake,	11/0-05004
W76-05701 5B	W76-05506 6B	CARMIGGELT, C. J. W.
BRAUNS, O.		Algal Nitrogen Fixation in Californian Streams:
Symposium on Water Purification (Symposium	BURIKS, R. S.	Seasonal Cycles,
over vattenrening),	Use of Polymeric Quaternary Ammonium	W76-05639 5C
W76-05711 5D	Betaines as Water Clarifiers,	
	W76-05544 5F	CARPENTER, E. J.
BRECHT, W.	BURNHAM, J. B.	Brackish-Water Phytoplankton Response to Temperature Elevation.
Water and Its Role in the World (Wasser und	A Technique for Environmental Decision Mak-	W76-05999 5C
was es in der Welt damit auf sich hat),	ing Using Quantified Social and Aesthetic	W 76-03999 3C
W76-05739 6D	Values,	CARR, J. R.
BREWNER I M	W76-05825 5G	Careful Sample Taking is Key to Successful
BREMNER, J. M.	BUBNC A W	Wells,
Control of Nitrogen Transformations in Soils, W76-05608 5B	BURNS, A. W. Evaluation of Data Availability and Examples	W76-05560 4B
W76-05608 5B	of Modeling for Ground-Water Management on	
BREWER, S. T.	Cape Cod, Massachusetts,	CARR, M. K. V.
Comparative Risk-Cost-Benefit Study of Alter-	W76-05856 4B	Irrigating Seedling Tea in Southern Tanzania:
native Sources of Electrical Energy,		Effects on Total Yields, Distribution of Yield
W76-05829 6B	BUTLER, B. E.	and Water Use. W76-05928 21
	Sludge Dewatering Trials at Banbury,	W 70-03926
BRINK, R. H. JR.	W76-05809 5D	CARTER, L.
Synergistic Compositions Containing 2,2-	BYSTROVA, T. A.	Apparatus for Collecting Surface Particle on
Dibromo-3-Nitrilopropionamide and 3,3,4,4-	Reduction of Effluent Volume and Fresh Water	Body of Water,
Tetrachlorotetrahydro-Thiopene-1,1-Dioxide	Consumption (Snizhenie ob'ema ctochnykh	W76-05970 5G
and Their Use, W76-05531 5F	vod i raskhoda svezhej vody),	CARMININ CA
W76-05531 5F	W76-05727 3E	CARTHEW, G. A.
BRITT, L. O.	CABEJSZEK, I.	Lime Recovery and Reuse in Primary Treat-
Lime Use in Wastewater Treatment: Design	Limnological Character of Experimental Reser-	ment, W76-05785 5D
and Cost Data,	voirs Treated with Tritox 30% (DDT, DMDT,	30
W76-05868 5D	GAMMA HCH),	CARVALLO, H. O.
	W76-06012 5C	Spatial Variability of in Situ Unsaturated
BROCK, T. D.	CATAL D. IV	Hydraulic Conductivity of Maddock Sandy
Temperature Optimum of Algae Living in the	CAIN, B. W. The Impact of Canyon Dam and Reservoir on	Loam,
Outfall of a Power Plant on Lake Monona,	Wildlife,	W76-05670 2G
W76-06001 5C	W76-05504 6G	CASSEL D. K
BROOKS, A. S.		CASSEL, D. K. Spatial Variability of in Situ Unsaturated
Primary Production.	CALLAHAN, M. W.	Hydraulic Conductivity of Maddock Sandy
W76-05874 5C	Biological Denitrification and its Application in	Loam,
30	Treatment of High-Nitrate Waste Water,	W76-05670 2G
BROWN, D. A.	W76-05792 5D	
Effect of Bleached Kraft Mill Effluent on the	CALLOWAY, J. A.	CEES, B.
Survival of Starved Juvenile Coho Salmon	An Economic Model of Water Use and Waste	Cause and Identification of Taste and Odour
(Oncorhynchus Kisutch),	Treatment,	Compounds in Water,
W76-05710 5C	W76-05814 5D	W76-06009 5A
BROWN, G.	CALMON C	CHADBOURNE, B. D.
Demand for Dissolved Oxygen Exerted by	CALMON, C. Detection Devices for Use in Solution	The Movement of Melting Ice over Rough Sur-
Finely Divided Logging Debris in Streams,	Processing Systems,	faces,
W76-05939 4C	W76-05532 5F	W76-05671 2C

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Multipurpose River Project Planning in the Lower Mekong Basin: A Decision Approach, W76-05762	An Evaluation of Some Recreational, Demo- graphic and Economic Impacts of Canyon Lake,	Availability of Ground Water in the Androscog- gin River Basin, Northern New Hampshire, W76-05862 7C
	W76-05506 6B	CRANE B M
CHAN, H. T.	CLARY C. T.	CRANE, D. M. Plan Formulation and Evaluation Studies
Movement of Tracers Through Soil, W76-05701 5B	CLARK, G. T. Industrial Cost Recovery and User Charge As-	Recreation. Vol. II of V. Estimating Initial Reservoir Recreation Use,
CHANDRA, S.	sessments, W76-05813 5G	W76-05611 6B
Application of Infrared Spectroscopy to Erodi-	W 70-03813	
bility Studies of the Soil,	CLARK, R. A.	CRAUN, G. F.
W76-06140 2J	Hydrologic Implications of Canyon Dam and Reservoir,	Outbreaks of Waterborne Disease in the United States, 1971-1972,
CHANTEFORT, A.	W76-05503 2H	W76-06138 5C
Experimental Study of the Purification of Ef-		CROOKS, GEOFFREY
fluents from the Manufacture of Bleached	CLARKE, G. K. C.	The Washington Shoreline Management Act,
Bisulfite Pulp by Aeration Lagooning (Etude experimentale de l'epuration par lagunage aere	The Thermal Regime of Trapridge Glacier and Its Relevance to Glacier Surging,	W76-06056 5G
de liqueurs bisulfitiques de pate de cellulose	W76-05916 2C	CSERMAK, B.
blanchie),	CLEMENTE, G. F.	Goals and Forms of Co-operation Among
W76-05718 5D	Instrumental Method for the Determination of	Countries for the Development of International River Basins,
CHAPPEL, R. M.	Trace Elements in Water Samples by Neutron	W76-05521 4A
Methods and Apparatus for Treating Waste-	Activation Analysis, W76-05998 5A	
water,	W/0-03220	CULLER, R. C. Relation of the Consumptive Use Coefficient to
W76-05987 5D	CLESCERI, N. L.	the Description of Vegetation,
CHARETTE, P. A.	A Description of the Trophic Status and	W76-05843 2D
The Permittivity and Attenuation in	Nutrient Loading for Lake George, New York,	11 /0-03043
Polycrystalline and Single-Crystal Ice Ih at 30	W76-05638 5C	CUMMINGS, R. E.
and 60 MHz,	CLICOLD D I	Protecting Groundwater from Landfill
W76-05672 2C	CLISSOLD, R. J.	Leachate,
	Yukon City's New Well Replaces Five Older Ones,	W76-05599 5G
CHEN, M.	W76-05566 4B	D'ITRI, F.
Effects of Salinity on Nitrification in the East	48	Wastewater Renovation and Reuse: An Urgent
River,	CLOUSTON, J. G.	Environmental Need,
W76-05631 5C	An Evaluation of the Use of Gamma Radiation in Sewage Treatment,	W76-05777 5D
CHENG, W. W.	W76-05803 5D	DACY, G. H.
Movement of Tracers Through Soil, W76-05701 5B	management and the second second	Reverse Osmosis Plant Helps City Cope with
W76-05701 5B	COFFEY, B. T.	Diminishing Groundwater Supply,
CHERNOGAYEVA, G. M.	Eurasian Water-Milfoil in Michigan,	W76-05779 5F
Maps of the Elements of the Hydrologic	W76-06149 5G	DALPKE, H. L.
Budget of Asia,	COLE, D. W.	Effluent Discharge Law-Burdens and Con-
W76-05934 2A	Nutrient Cycling in 37- and 450-Year-Old	sequences for the Paper Industry
CHERRY V E	Douglas-Fir Ecosystems,	(Abwasserabgabengesetz-Belastungen und Fol-
CHERRY, K. F.	W76-05619 5B	gerungen fuer die Papierindustrie),
Bio Pond Aerator, W76-05535 5D	Catalogue Terror and Al-Path III	W76-05712 5G
W76-05535 5D	COLE, R. M.	DAVES, G. D. JR
CHESSMAN, B. C.	The Movement of Melting Ice over Rough Sur-	Analysis of Pulp and Paper Mill Waste Waters
Distribution of Fish in Inland Saline Waters in	faces, W76-05671 2C	by High-Resolution Ion-Exchange Chromatog-
Victoria, Australia,	W/0-030/1	raphy,
W76-06143 2H	COLER, R. A.	W76-05709 5A
CHIAN F C K	Statistical Study of the Duckweed Rhizosphere	DAVIDEON H
CHIAN, E. S. K. Compilation of Methodology used for Measur-	as an Eco-Assay Tool,	DAVIDSON, H. Overwintering of Evergreens in Plastic Struc-
ing Pollution Parameters of Sanitary Landfill	W76-05605 5B	tures,
Leachate,	COLORNI, A.	W76-06014 2I
W76-05869 5A	Reservoir Management Via Reliability Pro-	
	gramming,	DAVIES, R. M.
CHILDNEY, M. R. Modeling the Effect of Waste Discharges in a	W76-05508 4A	Zooplankton Entrainment, W76-05876 5C
Small Mountain Stream,	CONTRACTOR, D. N.	DAVIC P
W76-05834 5B	Modeling the Effect of Waste Discharges in a	DAVIS, E. Optimizing Organic Carbon and Color Removal
CHIN P H	Small Mountain Stream,	from a Board Mill Effluent,
CHIN, E. H. The 1973 Mississippi Piver Basin Flood: Com	W76-05834 5B	W76-05724 5D
The 1973 Mississippi River Basin Flood: Com- pilation and Analyses of Meteorologic, Stream-	COOK, E.	
flow, and Sediment Data,	Some Economic and Decision Aspects of the	DAVIS, O. T.
W76-05860 2E	Canyon Project,	Water Purification Apparatus and Timing
	W76-05505 6B	Device for Initiating A Backwashing Cycle, W76-05968 5F
CHOO, IL-YOUNG		# 75-03908 3F
Studies on the Effects of Copper on the Lac-	COOK, G. H.	DAWSON, F. H.
tate Dehydrogenase and Esterase Isozymes in	Mirex Residues in Selected Estuaries of South	Notes on the Production of Stream Bryophytes
Various Tissues of Carassius Carassius, W76-05595	Carolina: June 1972, W76-05954	in the High Pyrenees (France), W76-06129

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21

DAY, H. J.	DESJARDINS, C. R.	DUCKSTEIN, L.
Benefit and Cost Analysis of Hydrological	Plan Formulation and Evaluation Studies-	Decision Making and Planning for River Basin
Forecasts,	Recreation. Vol. II of V. Estimating Initial	Development,
W76-05823 6B	Reservoir Recreation Use, W76-05611 6B	W76-05752 6A
DAY, J. C.	W /0-03611 6B	Long Range Planning of Water Resources: A
International Management of the River Plate	DEWALLE, F. B.	Multi Objective Approach,
Basin,	Compilation of Methodology used for Measur-	W76-05760 6A
W76-05756 4A	ing Pollution Parameters of Sanitary Landfill Leachate.	
Urban Water Management of an International	W76-05869 5A	DUGDALE, J.
River: The Case of El Paso -Juarez,	W 70-03803	Edinburgh's Sewage-Treatment and Disposal
W76-05661 3D	DHAR, O. N.	Scheme, W76-05794 5D
-04-44	Trend Analysis of Annual Indian Rainfall,	W 76-03794 3D
DAY, J. H.	W76-05691 2B	DUKE, P. L.
The Ecology of Morrumbene Estuary, Mozam- bique.	DISTEFANO, N.	Illinois Drainage LawThe Dominant Estate
W76-06127 2L	An Identification Approach to Subsurface	Owner May Not Increase the Rate or Amount
	Hydrological Systems,	of Surface Water Run-Off onto the Servient
DE-HEER-AMISSAH, A. N.	W76-05688 2F	Estate Beyond a Range Consistent with a Pol-
Surface Energy Budget of Some Climatic	DIVINSKAYA, B. SH.	icy of Reasonable Use, W76-06051 4A
Regimes in West Africa, W76-06006 2B	Possibility of Determining the Areas of Heavy	W 70-00031
W /0-00000 2B	Precipitation by Discrete Representation of	DUNMIRE, C. W.
DE LA FUENTE, E.	Radar Data,	Impact Sprinkler,
Lime Use in Wastewater Treatment: Design	W76-05933 2B	W76-05956 3F
and Cost Data,	DODD, V. A.	BUILDING W. G.
W76-05868 5D	Eutrophication of an Inland Lake in Ireland in	DUNN, K. S.
DE. S. K.	Association with the Intensification of Pig	Incineration's Role in Ultimate Disposal of Process Wastes,
Application of Infrared Spectroscopy to Erodi-	Farming in the Catchment Areas,	W76-05791 5E
bility Studies of the Soil,	W76-05629 5C	***************************************
W76-06140 2J	DODGE, A. Y.	DYRNESS, C. T.
	Method and Apparatus for Desalinization of	Impact of Clear-Cutting and Road Construction
DEAN, J. A. Determination of Selenium in Natural Waters	Water,	on Soil Erosion by Landslides in the Western
Using the Centrifugal Photometric Analyzer,	W76-05979 3A	Cascade Range, Oregon, W76-05614 40
W76-06128 2K	DOHNERT, E. H.	W /6-03614 4C
	Water Treating Apparatus,	Nutrient Cycling in 37- and 450-Year-Old
DEBANNE, J. G.	W76-05547 5F	Douglas-Fir Ecosystems,
Proposal for a Trans-Mediterranean Aqueduct,		W76-05619 5E
W76-05660 4A	DOMBOIS, D. M.	
DEJOHN, P. B.	A Non-Adapted Vegetation Interferes with Water Removal in a Tropical Rain Forest Area	DYSART, B. C. III Multi-Objective Water Resources Planning
Treatment of Dye Wastes With Granular Ac-	in Hawaii,	Methodology to Achieve Compatibility
tivated Carbon,	W76-06042 4A	Between Environmental Amenities and
W76-05738 5D	DOMOKOS M	Economic Development,
DEJONG, E.	DOMOKOS, M. Evaluation of the Effects of Water Transfer,	W76-05840 6E
Carbon Dioxide Evolution from Virgin and Cul-	W76-05751 6A	not a compared the second
tivated Soil as Affected by Management Prac-		Restoring the Quality of Urban Receiving Waters: Interfacing Upgraded Treatmen
tices and Climate,	DONDERSKI, W.	Facilities with the Stream,
W76-06003 2G	Generic Composition and Nutritional Require- ments of Bacteria Isolated from Three Lakes,	W76-05839 5E
DEMONT, D. J.	W76-06120 2H	
Fisheries Research,	W 10 00120	EARLL, R.
W76-05878 5C	DONTSOVA, M. I.	Selector Systems in Recording Physiologica
	Control of Coagulant Recovery from Effluent	and Behavioral Activity in Sedentary Aquatic
DENNERT, H. G.	Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod),	Animals, W76-06039 2
Further Observations on the Migration of Gam-	W76-05725 5E	W 10-00039
marus Zaddachisexton (Crustacea, Amphipoda) in a French Stream,		EDGINGTON, D. N.
W76-06046 2I	DROSTE, R. L.	Distribution of Amorphous, Diatom Frustule
	Quality and Variation of Pollutant Loads in	and Dissolved Silica in a Lead-210 Dated Cor-
DENONCOURT, R. F.	Urban Stormwater Runoff, W76-05576 5B	from Southern Lake Michigan,
An Ichthyofaunal Survey and Discussion of	1170-05570	W76-05883
Fish Species Diversity as an Indicator of Water Ouality, Codorus Creek Drainage, York Coun-	DROZDOV, N. P.	Distribution of Diatom Frustules in Lake
ty. Pennsylvania.	Purification of Gum Rosin Producing Plant Ef-	Michigan Sediment Cores,
W76-05634 5A	fluents from Resinous Substances (Ochistka stochnykh vod kanifol'noterpentinnogo proiz-	W76-05882 50
	vodstva ot smolistykh veshchestv),	
DEPREE, D. O.	W76-05735 5D	The Distribution of Plutonium in Lak
Buffered, Weak Ion-Exchange Water		Michigan Sediments, W76-05892 51
Demineralization Process, W76-05526 3A	Rapid Determination of the Cod of Effluents	······································
11 10-03320 3A	(Uskorennoe opredelenie KhPK stochnykh vod),	Geochronology of Lake Michigan Sediments
DERRIENNIC, F.	W76-05705 5A	Anomalies in Lead-210 Distributions,
Application of Factorial Analysis of Principal		W76-05885 51
Components to the Control of Pollution of Sur-	DRUFUCA, G.	Miami River Watershed Project: Introduction,
face Waters, W76-05632 5B	Statistics of Raingage Data, W76-05693 2B	W76-05886
11 10 03032 3B	11 13-03033 4B	

FR

EDGINGTON, D. N.

Plutonium Concentrations in Water and	EVANS, D. T.	FINZI, G.
Suspended Sediment from the Miami River	Selector Systems in Recording Physiological and Behavioral Activity in Sedentary Aquatic	Comment Upon Multivariate Synthetic
Watershed, Ohio, W76-05887 5B	Animals.	Hydrology, W76-05909 2A
W 70-03667	W76-06039 2I	W 70-03909
Plutonium in Aquatic Biota of the Great Miami		FISCHER, D. W.
River Watershed, Ohio,	EVANS, J. C.	Environmental Impact Assessment as an In-
W76-05888 5C	Grapevine Response to Furrow and Trickle Ir-	strument of Public Policy for Controlling
Stable Lead Geochronology of Fine-Grained	rigation, W76-06032 3F	Economic Growth, W76-05828 6G
Sediments in Southern Lake Michigan,		Distriction in the company of the last free
W76-05884 5B	EVANS, R. S.	Willingness to Pay as a Behaviourial Criterion
EDWARDS, J.	Anaerobic Digestion: The Rate-Limiting Process and the Nature of Inhibition,	for Environmental Decision-Making,
Effect of Plume Residence on the Accumula-	W76-05784 5D	W76-05826 5G
tion of Cs137 by Lake Michigan Salmonids,	1170 05704	FISCHER, Z.
W76-05902 5C	EWING, L. J.	Biology and Bioenergetics of Grass Carp
EDYE, L. A.	Water Factory 21 is the Future,	(Ctenopharyngodon Idella Val.),
The Annual Variation in Yield of Pastures in	W76-05782 · 5F	W76-06013 2I
the Seasonally Dry Tropics of Queensland,	FADIAH, Z.	ELEZGIMMONG C I
W76-06016 3F	Ionic Leaf Accumulation in Grapes, Guava and	FITZSIMMONS, S. J. Social Assessment Manual: A Guide to the
EHARA, L.	Olive Plants as Affected by the Salinity of Ir-	Preparation of the Social Well Being Account,
Desalination Process by Improved Multistage	rigation Water,	W76-05993 6B
Electrodialysis,	W76-06030 3C	
W76-05980 3A	FARRELL, R. P. JR.	FLETCHER, G. M.
	Process and Equipment for Automatic Chemi-	Watercraft for Scavenging Oil Spillage,
EISLER, R.	cal-Biological Wastewater Treatment with	W76-05548 5G
Second Annotated Bibliography on Biological	Provisions for Recycle and Reuse,	FOGEL, M. M.
Effects of Metals in Aquatic Environments, W76-05863 5C	W76-05955 5D	Environmental Considerations in River Basin
W 70-03803	PARILE A D	Planning and Decision Making,
EL-AZAB, E.	FAUKE, A. R. Use of Polymeric Quaternary Ammonium	W76-05510 4A
Ionic Leaf Accumulation in Grapes, Guava and	Betaines as Water Clarifiers,	
Olive Plants as Affected by the Salinity of Ir-	W76-05544 SF	FOLKENROTH, J. C.
rigation Water,		Coastal Zone Management and Intergovern-
W76-06030 3C	FEAR, J. V. D.	mental Coordination,
ELEMER, P.	Method of Reducing Sludge Accumulation	W76-06057 6E
Legal Framework of Co-Operation in the Field	from Tar Sands Hot Water Process, W76-05965 5D	FORD, G. W. K.
of Water Management Between Hungary and	W 70-03903	An Evaluation of the Use of Gamma Radiation
Her Neighboring Countries,	FEKETE, G.	in Sewage Treatment,
W76-05759 6E	The Role of Inland Navigation in River Basin	W76-05803 5D
ELLIOTT, S. T.	Development,	
Comparative Effectiveness of the Standard	W76-05511 4A	FORSTER, R. L.
Surber Sampler and a Hydraulic Modification	FERGUSON, J. F.	Port Collection and Separation Facilities for
for Estimating Bottom Fauna Populations,	The Fate of Nutrients in Back River,	Oily Wastes. Vol. 5. A Comparative Analysis of Conceptual System Plans for the Surveyed
W76-05613 7B	W76-05625 5C	Ports Under the 'No Discharge', '1969 Amend-
ELLIS, R. JR.		ments' and 'No Sheen' Criteria,
Interactions of Mercury with Aquatic and	FERNANDEZ DEL RIEGO, A.	W76-05830 5D
Edaphic Environments,	Distribution of Lignin in Waters of the Lou- rizan Inlet as a Measure of Contamination Due	THE RESERVE OF THE PARTY OF THE
W76-05601 5B	to Dumping of Lignosulfonic Liquors Resulting	FOSTER, H. D.
EMERSON, S.	from Production of Chemical Pulp (La dis-	Flood Loss Management in Developing Coun-
Chemically Enhanced C02 Gas Exchange in a	tribuction de la lignina en aguas de la ensenada	tries: A Model for Identifying Appropriate Strategies,
Eutrophic Lake: A General Model,	de lourizan, comomedida de la contaminacion a	W76-05761 6A
W76-05635 5C	causa del vertido de lejuas ligninsulfonicas,	
PRICECON C. M.	procedentes de la fabricacion de pasta de celu-	FOWLER, D. B.
ERICKSON, G. M.	losa), W76-05733 5G	Fecundity of the Brown Bullhead, Ictalurus
Experimental Well Field is Put to Many Uses, W76-05569 8G	H 10-03/33	Nebulosus (Le Sueur) in a Mine Acid Polluted
W 10-03309	FERRANTE, J. G.	River, W76-05641 81
ERSKINE, H. L.	Role of Copepod Fecal Pellets in the Vertical	W76-05641 8I
Recovering Bitumen from Large Water Sur-	Transport of Freshwater Diatoms,	FOX, D. M.
faces, W76-05992 5G	W76-05880 5C	Conversion of a Trickling Filter Plant to Ac-
W76-05992 5G	Vertical Transport of Particulate Material in	tivated Sludge,
ESVELT, L. A.	Lake Michigan by the Lorica of Codonella	W76-05588 5D
Industrial Cost Recovery and User Charge As-	Cratera,	FRANCIS, C. W.
sessments,	W76-05881 5C	Biological Denitrification and its Application in
W76-05813 5G	FERRIS, J. J.	Treatment of High-Nitrate Waste Water,
ETTELT, G. A.	A Description of the Trophic Status and	W76-05792 5D
Dissolved Air Floatation System,	Nutrient Loading for Lake George, New York,	ED LODD D C
W76-05976 5D	W76-05638 5C	FRASER, R. S.
ETZEL, J. E.	PINNEY C D	An Automated Technique for the Sub-Micro-
Detergent Phosphate Ban Yields Little	FINNEY, C. D. Anaerobic Digestion: The Rate-Limiting	gram Determination of Selenium and Arsenic in Surface Waters by Atomic Absorption Spec-
Phosphorus Reduction, Part I,	Process and the Nature of Inhibition,	troscopy,
W76-05637 5C	W76-05784 5D	W76-05736 SA

ic A

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G

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D

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D

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A

FRAUCHIGER, U. Apparatus for the Treatment of Liquid Wastes,	GALYANOVA, N. V. Rapid Determination of the Cod of Effluents	GLAS, T. K. Salt Transport in Soil Profiles with Application
W76-05967 5D	(Uskorennoe opredelenie KhPK stochnykh	to Irrigation Return Flow, The Dissolution and Transport of Gypsum in Soils,
FREDERICKS, R. G.	W76-05705 5A	W76-05836 5B
Water Level Gauge,		
W76-05977 7B	GANZ, C. R. Removal of Detergent Fluorescent Whitening	GODFRIAUX, B. L. Food of Tarakihi in Western Bay of Plenty and
FREDRIKSEN, R. L.		Tasman Bay, New Zealand,
The Impact of Timber Harvest, Fertilization,	Agents from Waste Water, W76-05804 5D	W76-06047 2L
and Herbicide Treatment on Streamwater	W 10-03004	
Quality in Western Oregon and Washington,	GARDNER, N. R.	GOLDSTEIN, G.
W76-05618 5B	Yeasts Isolated from Some Lakes and Rivers	Determination of Selenium in Natural Waters
W	of Saskatchewan,	Using the Centrifugal Photometric Analyzer, W76-06128 2K
Nutrient Cycling in 37- and 450-Year-Old	W76-06135 5B	W 70-00126 2K
Douglas-Fir Ecosystems, W76-05619 5B	GARRISON, C. B.	GOODMAN, A. H.
11/0/03/01/	Measuring and Minimizing the Social Cost of	Progress in Methods of Nitrate Removal,
Timber Production and Water Quality	Environmental Pollution,	W76-05805 5D
Progress in Planning for the Bull Run, Portland,	W76-05824 5G	GOODNOW, W. E.
Oregon's Municipal Watershed,		Aerated Lagoons Solve Town's Site Problems,
W76-05942 5B	GASS, T. E.	W76-05799 5D
FRIEDMAN, J. M.	History of Ground Water Concepts,	G000 G
Efficiency in Water Quality Control for the	W76-05551 2F	GOOS, G. Optimizing Organic Carbon and Color Removal
Willamette River,	History of Ground Water Development,	from a Board Mill Effluent,
W76-05658 5G	W76-05556 4B	W76-05724 5D
FRIERMAN, M.	GASSER, A.	GORDON, R. C. JR.
Epizootiology of Minchinia Nelsoni in	Process for Separating Oil from Emulsions of	Inhibition of Scale Deposition,
Susceptible Wild Oysters in Virginia, 1959 To	Oil in Water,	W76-05529 5D
1971, W76-06035 5C	W76-05964 5D	GORIN, P. A. J.
W 70-00033	GAUNTLETT, R. B.	Yeasts Isolated from Some Lakes and Rivers
FRIMPTER, M. H.	Nitrate Removal from Water by Ion Exchange,	of Saskatchewan,
Evaluation of Data Availability and Examples	W76-05806 5F	W76-06135 5B
of Modeling for Ground-Water Management on		COULDEN B B
Cape Cod, Massachusetts,	GELLMAN, I.	GOULDEN, P. D. Automated Dilution for Measurement of
W76-05856 4B	Status of Water Pollution Control in the Soviet	Nitrate in Water.
FRITZ, J. S.	Union,	W76-05594 5A
Removal of Copper and Iron Prior to Water	W76-05714 5G	
Hardness Titration,	GERMANA, A.	GRAY, E. A.
W76-05716 5A	Multistage Flash Evaporator for Producing Soft	Survival of Escherichia Coli in Stream Water in
	Water from a Saline Water,	Relation to Carbon Dioxide and Plant Photosynthesis,
FRONZA, G.	W76-05978 3A	W76-05628 3C
Reservoir Management Via Reliability Pro-		77.00000
gramming, W76-05508 4A	GHILDYAL, B. P.	GRAY, R. F.
W76-05508 4A	Evaporation Characteristics of Three Fine-Tex- tured Tarai Soils Under Various Evaporation	Introduction and Physical Description of Lake
FUHS, G. W.	Potentials,	Norman, W76-05871 5C
Effects of Salinity on Nitrification in the East	W76-06037 2D	W /0-038/1
River,		Thermal and Water Quality Characteristics of
W76-05631 5C	GILFILIAN, R. E.	Lake Norman,
PUTNO II	Nucleation Characteristics of Stream Water	W76-05872 5C
FUJINO, H. Reverse Osmosis Separation Apparatus,	and Frazil Ice Nucleation,	GRAY, S. L.
W76-05990 3A	W76-05695 2C	An Economic Analysis of Water Use in
W 10-03770	GILLARD, P.	Colorado's Economy,
FULLER, R. H.	The Annual Variation in Yield of Pastures in	W76-05837 6E
Selected Water-Quality Data from Fallen Leaf	the Seasonally Dry Tropics of Queensland,	
Lake, El Dorado County, California, June	W76-06016 3F	GREEN, D. W.
through October 1974,		Development and Field Testing of a Basin Hydrology Simulator,
W76-05848 7C	GILLETT, J. D. Breeding Places and Seasonal Incidence of	W76-05745 2A
GAHAN, L. W.	Aedes Aegypti, as Assessed by the Single-	
Multi-Objective Water Resources Planning:	Larva Survey Method,	GREENE, J. T.
Methodology to Achieve Compatibility	W76-06033 5G	Reforming Procedures for Industrial Siting,
Between Environmental Amenities and		W76-06058 6E
Economic Development,	GILLIES, R. G.	GREENE, M. L.
W76-05840 6B	Lab-Proven Fly Ash Process Removes Bleach	Line Motion and Water Current Disc Sensor,
GAINES, S. E.	Effluent Color,	W76-05539 7E
The International Law Aspects of the Garrison	W76-05707 5D	CRECORY N I
Diversion Project,	GILLILAND, E. J.	GREGORY, N. J. An Evaluation of the Use of Gamma Radiation
W76-06053 6E	Financing the New Water Authorities,	in Sewage Treatment,
	W76-05810 6C	W76-05803 SE
GALBRAITH, R.		
Subtidal Marine Biology of California, with	GITCHEL, W. B.	GRGIN, J. M.
Emphasis on the South, W76-06023 2L	Wastewater Treatment, W76-05961 5D	Rehabilitating an 80-Year Old Sewer System, W76-05764
W76-06023 2L	H 10-03701 3D	11 10-03 104 3L

Н

GRIER, C. C.	HALL, N. W.	HEDGES, L. S.
Nutrient Cycling in 37- and 450-Year-Old	Effective Use of High Water Table Areas for	Geology and Water Resources of Charles Mix
Douglas-Fir Ecosystems,	Sanitary Landfill. Vol. II,	and Douglas Counties, South Dakota, Part I
W76-05619 5B	W76-05744 5G	Geology,
GRIGG, N. S.	HALL, W. D.	W76-05923
Precipitation Management for Reclamation of	Aquifer Evaluation Using Depositional	HEFEZ, E.
Overgrazed Areas in Arid and Semi-Arid Re-	Systems: An Example in North-Central Texas,	Forecasting Water Levels in Aquifers by Nu-
gions,	W76-05554 2F	merical and Semihybrid Methods,
W76-05603 2B		W76-05686 2F
	HALLBERG, R. O.	
GRONKVIST, S.	Vyredox-In Situ Purification of Ground Water,	HEIMBACH, J. A. JR.
Chemical Precipitation of Wastewaters with	W76-05553 5F	Field Observations of the Persistence of Agl
Lime (Kemisk fallning av avloppsvatten med	HAMMOND, J.	NH4I-Acetone Ice Nuclei in Daylight, W76-05677 3E
kalk),	Spatial Variability of in Situ Unsaturated	W 70-03077
W76-05585 5D	Hydraulic Conductivity of Maddock Sandy	HEINONEN, J.
GROOT, J. M.	Loam.	The Reliability of Mercury Analysis in En
The Performance of Surface and Sub-Surface	W76-05670 2G	vironmental Materials,
Drainage of Heavy Clay Soils in Yugoslavia,		W76-06007 5A
W76-06116 2G	HAMZA, H. A.	HEINGOHN C P
	Method and Apparatus for Centrifugally	HEINSOHN, G. E.
GRUHLER, J.	Separating Finely Divided Solids from Aqueous	Effects of a Tropical Cyclone on Littoral and Sub-Littoral Biotic Communities and on a
For Which Load Shall Municipal Purification	Suspensions Thereof,	Population of Dugongs (Dugong Dugon
Plants be Dimensioned. (Fuer Welche	W76-05543 5D	(Muller)),
Belastung Sollen Kommunale Klaeranlagen	HANNIGAN, J. T.	W76-06131 2I
Bemessen Werden), W76-05609 5D	Combined Waste Treatment Proves Economi-	
# /0-03009 3D	cal and Feasible.	HELGORSKY, J.
GUBANOV, A. A.	W76-05787 5D	Purification of Waste Water Containing Phthal
Exploitation of the Waters of Subpermafrost		ic Esters,
Artesian Basins,	HANSON, R. L.	W76-05982 5E
W76-05930 3B	Relation of the Consumptive Use Coefficient to	HENDRICKS, A. C.
	the Description of Vegetation,	Eutrophic Gradient in Smith Mountain Lake
GUBANOV, B. A.	W76-05843 2D	Virginia,
Exploitation of the Waters of Subpermafrost	HARRISON, W. D.	W76-05627 50
Artesian Basins,	Some Observations on the Behavior of the	W 70-03027
W76-05930 3B	Liquid and Gas Phases in Temperate Glacier	HENRY, H. W.
GUPTA, B. S.	Ice,	Measuring and Minimizing the Social Cost of
Behaviour of Some Phosphatic Fertilizers in	W76-05915 2C	Environmental Pollution,
Water,	11.0.0515	W76-05824 50
W76-06139 5B	HARTMAN, W. J.	HERDENDORF, C. E.
as any of males or the supplement of but on the	Municipal Wastewater Odor Still a Problem	Mercury Occurrence in Sediment Cores from
GUSTINIS, J.	Part 1,	Western Lake Erie,
Geochronology of Lake Michigan Sediments:	W76-05773 5D	W76-06137 5E
Anomalies in Lead-210 Distributions,		W 70-00157
W76-05885 5B	HARTT, J. P.	HERER, D. O.
GUY, H. P.	Quality and Variation of Pollutant Loads in Urban Stormwater Runoff,	Electrolytic Coagulation of Lignin from Kraf
The 1973 Mississippi River Basin Flood: Com-	W76-05576 5B	Mill Bleach Plant Wastewaters,
pilation and Analyses of Meteorologic, Stream-	# 70-03370 3B	W76-05708 5E
flow, and Sediment Data,	HATCHER, R. F.	HERSHMAN, M. J.
W76-05860 2E	Microbiological and Chemical Enrichment of	Coastal Zone Management and Intergovern
	Freshwater-Surface Microlayers Relative to the	mental Coordination,
GWINN, W. R.	Bulk-Subsurface Water,	W76-06057 6E
Dependable Yield of Reservoirs with Intermit-	W76-06124 5C	
tent Inflows,		HIGER, A. L.
W76-05908 4A	HATVA, T. Examination and Removal of Iron in Ground-	Relation of Water Level and Fish Availability
Discharge Equations for HS, H, and HL	examination and Removal of Iron in Ground- water.	to Wood Stork Reproduction in the Southern
Flumes,		Everglades, Florida,
W76-05918 8B	W76-05571 5B	W76-05850 2
11 / 0 0 0 7 1 0 0 B	HAUMANN, J.	HIROTA, K.
HAAN, C. T.	Developments in Underwater Radiotelemetry	Method of Preventing Scale From Being
Supply and Demand in Water Planning:	and Preliminary Fish Tracking in Thermal	Deposited In Case of Producing Fresh Water
Streamflow Estimation and Conservational	Plumes,	From Sea Water,
Water Pricing,	W76-05893 5C	W76-05971 3A
W76-05607 6D	HAWVES C. I.	
Heine Desemble Madels of Desemble 1	HAWKES, C. L.	носитт, с. н.
Using Parametric Models of Runo! f to Improve Parameter Estimates for Stochastic Models,	Estimating Dry Weight of Live,	Assessment of a Stressed Macroinvertebrate
W76-05911 2E	Unanesthetized Fish by Photography, W76-05615 5A	Community,
W 10-03711 ZE	W76-05615 5A	W76-05636 50
HADDEN, L. C.	HEAPS, D. M.	HOEHN, R. C.
Sewage Treatment and Recycling System,	Canadian Water Resources Information: A	Modeling the Effect of Waste Discharges in
W76-05988 5D	Network Approach,	Small Mountain Stream,
	W76-05952 10D	W76-05834 SE
HAINS, J. J.	HERET B V IN	
Thermal and Water Quality Characteristics of	HEBEL, R. N. JR.	HOELTGEN, J. B.
Lake Norman, W76-05872 5C	Underwater Wall Structure, W76-05523 8A	Liquid Purifying Process,
30	W76-05523 8A	W76-05528 5I

F

1-A

d a n

ı. D

c of G

D I-

ı

g

e

O

HOFFMAN, G. L.	HUTCHINGS, P. A.	JANSSON, U. M. B.
Parasites of Freshwater Fishes. A Review of their Control and Treatment,	The Fauna of Careel Bay with Comments on the Ecology of Mangrove and Sea-Grass Com-	Chemical Characterization of Fiber Building Board Mill Effluent,
W76-05953 2H	munities,	W76-05731 5A
HOFFMANN, J.	W76-06022 2L	IADVIC C T
Temperature Optimum of Algae Living in the	HUTCHINS, R. A.	JARVIS, G. T. The Thermal Regime of Trapridge Glacier and
Outfall of a Power Plant on Lake Monona,	Treatment of Dye Wastes With Granular Ac-	Its Relevance to Glacier Surging,
W76-06001 5C	tivated Carbon, W76-05738 5D	W76-05916 2C
HOJERSLEV, N.	HWANG, C. P.	JEHN, P. J.
A Spectral Light Absorption Meter for Mea-	Optimizing Organic Carbon and Color Removal	The Chemical Speciation of PU-239, PU-240
surements in the Sea, W76-05680 7B	from a Board Mill Effluent,	and CS-137 in Lake Michigan Waters, W76-05889 5B
	W76-05724 5D	
HOLBERGER, R.	HYDRA, R.	Effect of Municipal Treatment Processes on PU-239, PU-240, and CS-137,
Impacts of Hydrologic Modification on Water Quality,	Plan Formulation and Evaluation Studies Recreation. Vol. II of V. Estimating Initial	W76-05890 5F
W76-05866 5G	Reservoir Recreation Use,	
HORAN, R. E. JR.	W76-05611 6B	Sedimentary Pu-239, Pu-240 Phase Distribu- tions in Lake Michigan Sediments,
Pollution Control System for Water Supply,	ISHCHERIKOVA, G. A.	W76-05891 5B
W76-05530 5F	Purification of Gum Rosin Producing Plant Ef-	
AND THE RESERVE AND THE PERSON NAMED IN COLUMN 1	fluents from Resinous Substances (Ochistka	JENNINGS, M. E.
HORNE, A. J.	stochnykh vod kanifol'noterpentinnogo proiz- vodstva ot smolistykh veshchestv),	Steady-State Segmented Dissolved-Oxygen Model,
Algal Nitrogen Fixation in Californian Streams: Seasonal Cycles,	W76-05735 5D	W76-05855 5B
W76-05639 5C	Rapid Determination of the Cod of Effluents	
HORNING B H	(Uskorennoe opredelenie KhPK stochnykh	JENSEN, L. D. Benthic Invertebrates.
HORNING, R. H. Biological Treatment of Dyes,	vod),	W76-05877 5C
W76-05737 5D	W76-05705 5A	
30	IVES, J. D.	Environmental Responses to Thermal
HORSTKOTTE, G. A.	The Microenvironment of Climacium Amer-	Discharges from Marshall Steam Station, Lake Norman, North Carolina,
Lime Recovery and Reuse in Primary Treat-	icanum, W76-06045 2G	W76-05870 5C
ment, W76-05785 5D		
In the second se	IWAI, S.	Introduction and Physical Description of Lake Norman,
HORTON, M. L.	Removal of Ammonia Nitrogen by Catalytic Oxidation Filter Bed (Sesshoku sanka rosho ni	W76-05871 5C
Water Movement Within the Root Zone of Ir- rigated and Nonirrigated Grain Sorghum,	yoru ammonia-set chisso no jokyo),	
W76-05994 2G	W76-05589 5D	Plankton Populations,
Till a line	IWANO, H.	W76-05873 5C
HOWELL, H. H. Some of the Effects of Domestic Sewage	Method of Treating Waste Liquids from Photo-	Primary Production,
Discharge into Hickman and Jessamine Creeks	graphic Processings, W76-05963 5D	W76-05874 5C
in Jessamine County, Kentucky,	W76-05963 5D	Thermal and Water Quality Characteristics of
W76-05841 5B	JACKSON, B. J.	Lake Norman,
HRBACEK, J.	Stream Bed Stabilization in Enfield Creek, New York.	W76-05872 5C
On the Possibilities of Averaging the Seasonal	W76-06145 8I	Zooplankton Entrainment,
Pattern in Kjeldahl Nitrogen in a Group of	TACOBORN W. F.	W76-05876 5C
Water Bodies,	JACOBSEN, W. E. Impacts of Hydrologic Modification on Water	- 1 1 / All Sale Land
W76-06019 5B	Quality,	JERMAR, M. The Czechoslovak Water Development
HUDSON, D. E.	W76-05866 5G	Planning Approach and Its Application,
Seismic Instrumentation of Dams,	JACOBSON, C. D.	W76-05749 6A
W76-05667 8D	New System Puts the Wood to Wastewater,	JOHARI, G. P.
HUFSCHMIDT, M. M.	W76-05586 5D	The Permittivity and Attenuation in
Management of Environmental Quality: Obser-	JAKOBSEN, B. F.	Polycrystalline and Single-Crystal Ice Ih at 30
vations on Recent Experience in the United	Water and Phosphate Transport to Plant Roots, W76-06002 21	and 60 MHz,
States and the United Kingdom, W76-05659 5G	W76-06002 2I	W76-05672 2C
	JAMES, M. E.	JOHNSON, F. L.
HULTMAN, B.	Geology and Geomorphology of the H. J. Andrews Experimental Forest, Western Cascades,	Flood-Caused Tree Mortality Around Illinois
Chemical Precipitation of Wastewaters with Lime (Kemisk fallning av avloppsvatten med	Oregon,	Reservoirs, W76-06027 4A
kalk),	W76-05941 4D	4A
W76-05585 5D	JAMES, R.	JONES, G. B.
HUMPHREY, H. E. B.	Industrial Cost Recovery and User Charge As-	Molybdenum in a Nearshore and Estuarine En-
Liquid Purifying Process,	sessments,	vironment, North Wales. W76-06000 2K
W76-05528 5D	W76-05813 5G	
Wiee W	JAMIESON, D. G.	JONES, J. E.
HUSE, H. Sewage Treatment System.	Real-Time Management of Water-Resource	Relation of the Consumptive Use Coefficient to the Description of Vegetation,
W76-05969 5D	Systems, W76-05747 6A	W76-05843 2D

AUTHOR INDEX

JONES, M. W.

JONES, M. W. Some of the Effects of Domestic Sewage	KASI VISWANATH, G. Factors in the Purification of Flowing Sewage	KIRCHMANN, R. Contamination of Freshwater by Mn54 and
Discharge into Hickman and Jessamine Creeks	and Activated Sludge Process, Part I, W76-05795 5D	Co60,
in Jessamine County, Kentucky, W76-05841 5B		W76-05903 5C
	KATSURA, Y.	KIRCHNER, W. B.
JONES, R. D.	Regional Plant Treats Septic Wastes, W76-05771 5D	The Effect of Oxidized Material on the Vertical
Benthic Invertebrates, W76-05877 5C	W 76-03771 3D	Distribution of Freshwater Benthic Fauna, W76-05743 5C
W 10-03811	KATZAKIAN, A. JR.	W /6-03/43
JONES, R. E.	Buffered, Weak Ion-Exchange Water	KIRK, B. S.
The Effects of Size-Selection Predation and	Demineralization Process,	Methods and Apparatus for Treating Waste-
Environmental Variation on the Distribution	W76-05526 3A	water,
and Abundance of a Chironomid, Paraborniella Tonnoiri Freeman.	KAWAMURA, S.	W76-05987 5D
W76-06130 21	Design and Operation of High-Rate Filters	KIRKPATRICK, G. A.
	Part 2,	An Assessment of Automatic Sewer Flow Sam-
JONES, S. J.	W76-05831 . 5D	plers - 1975,
Brittle Fracture of Ice at 77 K, W76-05673 2C	Design and Operation of High-Rate Filters	W76-05864 5D
W10-03013	Part 3,	Sewer Flow Measurement - A State-Of-The-Art
JORDEN, R. M.	W76-05832 5F	
Lime-Induced Reactions in Municipal Waste-	VAVES T B	Assessment, W76-05865 5D
waters, W76-05597 5D	KAYES, T. B. Lake Wingra, 1837-1973: A Case History of	
W76-05597 5D	Human Impact,	KITAO, K.
JORGENSEN, S. E.	W76-05997 5C	Effect of the Operational Temperature in
Ion Exchanger for the Treatment of Waste		Reverse Osmosis Method (Gyaku shinto ho ni
Water,	KEATING, E. J.	okeru sosa ondo no eikyo),
W76-05962 5D	Eutrophication of an Inland Lake in Ireland in Association with the Intensification of Pig	W76-05592 5D
JOUZEL, J.	Farming in the Catchment Areas,	Removal of Ammonia Nitrogen by Catalytic
Isotopic Study of Hail,	W76-05629 5C	Oxidation Filter Bed (Sesshoku sanka rosho ni
W76-05665 2B		yoru ammonia-set chisso no jokyo),
SECTION AND A	KEINATH, T. M.	W76-05589 5D
JURY, W. A. Solute Travel-Time Estimate for Tile-Drained	Restoring the Quality of Urban Receiving Waters: Interfacing Upgraded Treatment	KITCHELL, J. F.
Fields: II. Application to Experimental Studies,	Facilities with the Stream,	Lake Wingra, 1837-1973: A Case History of
W76-05905 5B	W76-05839 5D	Human Impact,
		W76-05997 5C
Solute Travel-Time Estimates for Tile-Drained	KEITH, L. H.	A.C. Carrier and C
Fields: I. Theory, W76-05904 5B	Chemical Characterization of Industrial Waste- waters by Gas Chromatography-Mass Spec-	KLAUNIG, J.
1170-03704	trometry,	Acute Toxicity of a Native Mummichog Popu-
KAKAR, Y. P.	W76-06008 5A	lation (Fundulus Heteroclitus) to Mercury, W76-05742 5C
Automated Dilution for Measurement of	WELLBER W. D.	W 10-05/42
Nitrate in Water, W76-05594 5A	KEMPER, W. D. Reclamation of Soils Contaminated with	KLEIN, A.
W 10-03374	Radioactive Strontium,	Stream Analyzers are for Waste as Well as
KAMAYA, M.	W76-05906 5G	Product,
Desalination Process by Improved Multistage		W76-05596 5A
Electrodialysis,	KHELMANIS, V. P. Flood Routing in Channel Systems with Al-	KLOOSTERBOER, J. G.
W76-05980 3A	lowance for Bank Regulation,	Rapid Photochemical Decomposition of Or-
KANAMARU, N.	W76-05668 4A	ganic Mercury Compounds in Natural Water,
Reverse Osmosis Separation Apparatus,		W76-05715 5A
W76-05990 3A	KIDD, C. H. R.	PNARR R M
KANAMORI, M.	QUURM - A Realistic Urban Runoff Model,	KNAPP, R. M. Development and Field Testing of a Basin
Method of Extracting Heavy Metals from In-	W76-05577 2A	Hydrology Simulator,
dustrial Waste Waters,	KIEMENEIJ, A. M.	W76-05745 2A
W76-05966 5D	Rapid Photochemical Decomposition of Or-	
KAPILASHRAMI, S.	ganic Mercury Compounds in Natural Water,	KNOPP, P. V.
Chemical Precipitation of Wastewaters with	W76-05715 5A	Wastewater Treatment,
Lime (Kemisk fallning av avloppsvatten med	KIMBALL, S. L.	W76-05961 5D
kalk),	Plant Development Under Snow,	косн, Е.
W76-05585 5D	W76-06147 2I	Hydrogeochemical Data from Investigation of
KAPLAN, A. M.	KINDLER, J.	Water Quality in Sewered and Unsewered
Process for Treating Waste Water Containing	A Case Study Report on the Vistula River	Areas, Southern Nassau County, Long Island,
Cellulose Nitrate Particles,	Basin,	New York, W76-05858 70
W76-05575 5D	W76-05514 4A	11.0-03030
KARTTUNEN, J. O.	The Out-Of-Kilter Algorithm and Some of its	KOEPP, S.
The Distribution of Plutonium in Lake	Applications in Water Resources,	Acute Toxicity of a Native Mummichog Popu-
Michigan Sediments,	W76-05515 6A	lation (Fundulus Heteroclitus) to Mercury,
W76-05892 5B	KING, J. N.	W76-05742 5C
Geochronology of Lake Michigan Sediments:	Removal of Copper and Iron Prior to Water	KONDRAT'YEV, N. YE.
Anomalies in Lead-210 Distributions,	Hardness Titration,	Hydraulic Computation of a Pool Hollow,
W76-05885 5B	W76-05716 5A	W76-05931 2E

1

D

D

D

in ni D ic ni

of C

uiC

as A

r-

in 2A

SD

of red nd,

ou-SC

2E

KORMANIK, R.	LASENBY, D. C.	LIS, A. W.
How Does Tank Geometry Affect the Oxygen Transfer Rate of Mechanical Surface Aerators. W76-05593 5D	Development of Oxygen Deficits in 14 Southern Ontario Lakes, W76-05679 5C	Analysis of Pulp and Paper Mill Waste Waters by High-Resolution Ion-Exchange Chromatog- raphy.
		W76-05709 5A
KOSEKI, M. Activated Carbon Treatment of Pulp and Paper	LASTIHENOS, J. Brooklyn Plant Meets Major Challenges,	LIUM, B. W. Limnological Data for the Major Streams in
Waste Water, W76-05730 5D	W76-05768 5D	Chester County, Pennsylvania,
	LASZLO, D.	W76-05852 7C
KOSS, R. W.	Long Range Planning of Water Resources: A	LIUZZO, G.
Benthic Invertebrates, W76-05877 5C	Multi Objective Approach, W76-05760 6A	Multistage Flash Evaporator for Producing Soft Water from a Saline Water,
KOVACIK, T. L.	LECH, JOHN, J.	W76-05978 3A
Mercury Occurrence in Sediment Cores from	Glucuronide Formation in Rainbow Trout: Ef-	
Western Lake Erie,	fect of Salicylamide on the Acute Toxicity,	LOCKWOOD, G. Balanced Sprinkler Impact Drive,
W76-06137 5B	Conjugation and Excretion of 3- Trifluoromethyl-4-Nitrophenol,	W76-05957 3F
KRAUS, K. A.	W76-06031 5C	LOFGREN, B. E.
Cross-Flow Filtration and Axial Filtration,		Land Subsidence and Aquifer-System Compac-
W76-05788 5D	LECLERC, A.	tion in the San Jacinto Valley, Riverside Coun-
	Application of Factorial Analysis of Principal	ty, CaliforniaA Progress Report,
KUBIK, M.	Components to the Control of Pollution of Sur-	W76-05847 2F
Use of Ion Exchangers and Synthetic Sorbents	face Waters,	LOGUE, D. E.
for Removal of Color from Kraft Process ef-	W76-05632 5B	The Economics of Alternative Deep Seabed
fluents (Proby zastosowania jonitow i sor-	LEE, CHOON-KOO	Regimes,
bentow syntetycznych do usuwania barwy ze sciekow posiarczanosych),	Studies on the Effects of Copper on the Lac-	W76-05816 6E
W76-05698 5D	tate Dehydrogenase and Esterase Isozymes in	LONG B :
W 70-03070	Various Tissues of Carassius Carassius,	LONG, D. A.
KUBYSHKIN, G. P.	W76-05595 5C	Municipal Wastewater Odor Still a Problem- Part 1,
Estimate of the Effect of Flood-Plain Drainage		W76-05773 5D
on the Annual and Maximum Runoff of Small	LEE, G. F.	470-03773
Rivers in the Ukraine (Dnieper Basin),	Studies on the Ca, Mg, and Sr Content of	LOPUSHINSKY, W.
W76-05676 4A	Freshwater Clamshells,	Soil Stability and Water Yield and Quality,
WIIRDINA NOV. W. W.	W76-06119 2H	W76-05937 4D
KUPRIYANOV, V. V.	IPP B C V	LOTSPEICH, F. B.
Hydrologic Aspects of Urbanization, W76-05925 4C	LEE, P. C. Y. Finite Element Mesh Gradation for Surface	Effects of Forest Fertilization on Two Southeast Alaska Streams,
KUSHLAN, J. A.	Waves, W76-05919 8E	W76-05612 5C
Differential Responses to Drought in Two Spe-	W 70-03919 6E	
cies of Fundulus,	LEMARQUAND, D.	LOUSIER, J. D.
W76-06132 2H	International River Basin Cooperation: Some	Response of Soil Testacea to Soil Moisture
	Factors Influencing Agreement,	Fluctuations, W76-06038 2G
Relation of Water Level and Fish Availability	W76-05758 6E	W 70-00036
to Wood Stork Reproduction in the Southern	TRAVE A P	LOWTHION, D.
Everglades, Florida,	LEMKE, A. E.	The Combined Effects of High Salinity and
W76-05850 2I	Comparative Toxicity of Polyelectrolytes to Selected Aquatic Animals,	Temperature on the Survival of Young Liman-
LAGERWERFF, J. V.	W76-05740 5C	da Limanda,
Reclamation of Soils Contaminated with	W 10-03/40	W76-06148 5C
Radioactive Strontium,	LERNER, A. D.	LOYTTYNIEMI, K.
W76-05906 5G	Alignment of Longitudinally Aerating Aeration	Transfer of Lindane from Bark of Insecticide-
	Tanks (Naladka aerotankov prodlennoy aerat-	Sprayed Pine Pulpwood into Effluent from a
LAMOREAUX, T. C.	sii),	Barking Drum (Lindaanin huuhtoutumisesta
An Automated Technique for the Sub-Micro-	W76-05587 5D	suojaruiskutetun mantykuitupuun kuoresta
gram Determination of Selenium and Arsenic in Surface Waters by Atomic Absorption Spec-	LEVE, G. W.	rumpukuorimon jateveteen), W76-05734 5B
troscopy,	Floridan Aquifer in Northeast FloridaThree	W 76-03734 3B
W76-05736 5A	MapsHardness of Water, Chloride Concentra-	LUCK, E.
	tion, and Potentiometric Surface, May 1974,	Sewage Treatment,
LANCELOT, C. J.	W76-05859 7C	W76-05582 5D
Detergent Phosphate Ban Yields Little		LUCKE, J. B.
Phosphorus Reduction, Part I,	LIE, U.	Minimizing the Operating and Capital Costs of
W76-05637 5C	Distribution and Structure of Benthic Assem-	Water Supply Projects,
LAND, J. E.	blages in Puget Sound, Washington, USA, W76-06015 5B	W76-05522 6A
Nature and Stability of Complex Mercury	11 /5-00013 3B	IIICZAY I
Compounds in Surface and Ground Waters,	LIEBERT, C.	LUCZAK, J. Limnological Character of Experimental Reser-
Phase II,	Removal of Detergent Fluorescent Whitening	voirs Treated with Tritox 30% (DDT, DMDT,
W76-05838 5A	Agents from Waste Water,	GAMMA HCH),
	W76-05804 5D	W76-06012 5C
LAPERRIERE, J. D.	LINDEDMANN F.C	
Evaluation of the Trophic Types of Several	LINDERMANN, E. G. Detergent Phosphate Ban Yields Little	LUE-HING, C.
Alaskan Lakes by Assessment of the Benthic Fauna.	Detergent Phosphate Ban Yields Little Phosphorus Reduction, Part I,	Biological Nitrification of Sludge Supernatant by Rotating Disks,
W76-05604 5C	W76-05637 5C	W76-05800 5D
50		

AUTHOR INDEX

MC

ME

MI

LUTHII		

LUTHIN, J. N.	MARCHANT, W. N.	MATZKE, W. H.
Coupled Saturated-Unsaturated Transient Flow in Porous Media: Experimental and Numeric	Method for Removing Soluble Selenium from Acidic Waste Water,	Escher-Wyss Flotation Cells for Clarification and Cleaning (Die Escher-Wyss Flotationszel-
Model,	W76-05986 5D	len zur Klaerung und Reinigung),
W76-05684 2F	MARESCA, J. W JR.	W76-05723 5D
LYAKHNOVICH, V. P.	Lake and Shore Ice Conditions on Southeast-	MCCABE, L. J.
Biology and Bioenergetics of Grass Carp	ern Lake Michigan in the Vicinity of the	Outbreaks of Waterborne Disease in the United
(Ctenopharyngodon Idella Val.),	Donald C. Cook Nuclear Plant: Winter 1973-74,	States, 1971-1972,
W76-06013 2I	W76-05664 2C	W76-06138 5C
LYKINS, B. W. JR.	MARIC, L. J.	MCCONNELL, W. J.
Interim Report on the Impact of Public Law 92-	Extraction - Visible Spectrophotometric	Emory Oak (Quercus Emoryi) Litter Phenolics
500 on Municipal Pollution Control Technolo-	Method for Determination of Nitrate: Applica-	as Environmental Hazards for Aquatic Animals
gy, W76-05867 5D	tion to Water Analysis, W76-05717 5A	in Southeastern Arizona, W76-06125 5B
W76-05867 5D	1170-05717	
MACAULAY, I. D.	MARSHALL, J. S.	MCCORMICK, M.
Trace Metals in the Waters of the Gulf of St.	Effect of Municipal Treatment Processes on PU-239, PU-240, and CS-137,	Acute Toxicity of a Native Mummichog Popu- lation (Fundulus Heteroclitus) to Mercury,
Lawrence, W76-06024 5A	W76-05890 5F	W76-05742 5C
W 70-00024		
MACDONALD, D. G.	Role of Copepod Fecal Pellets in the Vertical	MCCORQUODALE, J. A.
Lab-Proven Fly Ash Process Removes Bleach	Transport of Freshwater Diatoms, W76-05880 5C	A Stable Numerical Model for Local Scour, W76-05666 2J
Effluent Color, W76-05707 5D	W 70-03880 JC	1770-03000
W 70-03707	MARTIN-BOUYER, G.	MCCOWN, R. L.
MACDONALD, K. B.	Application of Factorial Analysis of Principal	The Annual Variation in Yield of Pastures in
Carbon Dioxide Evolution from Virgin and Cul-	Components to the Control of Pollution of Sur- face Waters.	the Seasonally Dry Tropics of Queensland, W76-06016 3F
tivated Soil as Affected by Management Prac- tices and Climate,	W76-05632 5B	W 70-00010
W76-06003 2G		MCHENRY, J. R.
	Evaluation of Surface Water Pollution at	Fallout CS-137: A Tool in Conservation
MACINKO, G.	Several Points in Relation to Zones of Shellfish Industry in Roadsteads of the Brest Region, (In	Research, W76-05690 2J
The Columbia Basin Project Reappraised, W76-05750 4A	French).	W 70-03090
W76-05750 4A	W76-06150 5B	MCKEAN, J. R.
MACK, R.	MARKEN D. T.	An Economic Analysis of Water Use in
Criteria for Evaluation of Social Impacts of	MARTIN, R. J. Automation Can Be Simple,	Colorado's Economy, W76-05837 6B
Flood Management Alternatives, W76-05653 6B	W76-05797 5D	W 70-03637
W 70-03033		MCLACHLAN, A.
MADDOCK, T. JR.	MARTIN, W. E.	Notes on the Biology of Some Estuarine
Equations for Resistance to Flow and Sediment	Economic Magnitudes and Economic Alterna- tives in Lower Basin use of Colorado River	Bivalves, W76-06134 2L
Transport in Alluvial Channels, W76-05844 2J	Water,	11.000131
W 70-03044 23	W76-05811 3A	MCLAUGHLIN, R. K.
MAGNUSON, J. J.	MARTINELL, R.	Analysis of Pulp and Paper Mill Waste Waters by High-Resolution Ion-Exchange Chromatog-
Lake Wingra, 1837-1973: A Case History of	Vyredox-In Situ Purification of Ground Water,	raphy,
Human Impact, W76-05997 5C	W76-05553 5F	W76-05709 5A
W 10-03391	MADEIGHT N	MCLEAY, D. J.
MALESZEWSKA, J.	MARUICHI, N. Desalination Apparatus,	Effect of Bleached Kraft Mill Effluent on the
Limnological Character of Experimental Reser-	W76-05959 3A	Survival of Starved Juvenile Coho Salmon
voirs Treated with Tritox 30% (DDT, DMDT, GAMMA HCH),		(Oncorhynchus Kisutch),
W76-06012 5C	MASTINU, G. G. Instrumental Method for the Determination of	W76-05710 5C
	Trace Elements in Water Samples by Neutron	Sensitivity of Blood Cell Counts in Juvenile
MALHOTRA, S. K. Design, Operation, and Monitoring of Mu-	Activation Analysis,	Coho Salmon (Oncorhynchus Kisutch) to Stres-
nicipal Irrigation Systems,	W76-05998 5A	sors Including Sublethal Concentrations of Pulp
W76-05783 5E	MATHUR, D.	Mill Effluent and Zinc, W76-05696 5C
MANCPIELD T A	Food Habits of the Rough Shiner, Notropis	11 / 0-03070 SC
MANSFIELD, T. A. Detection and Preliminary Identification of En-	Baileyi Suttkus and Raney, in Halawakee	MCLELLON, W.
dogenous Antitranspirants in Water-Stressed	Creek, Alabama,	Effective Use of High Water Table Areas for Sanitary Landfill. Vol. II,
Sorghum Plants,	W76-06126 2I	W76-05744 5G
W76-06026 2I	MATHUR, T.	
MAR, B. W.	Role of Phenylmercuric Acetate on Stomatal	MCLEOD, R. S.
Systems Approach to River Basin and Inter-	Regulation and Water Loss in Prosopis Cineraria Linn,	A Digital-Computer Model for Estimating Hydrologic Changes in the Aquifer System in
basin Development,	W76-06011 5G	Dane County, Wisconsin,
W76-05512 4A		W76-05851 2F
MARCHAND, M.	MATSUMOTO, R. Flowmeter for an Open Aqueduct,	MCNABB, C. D.
Experimental Study of the Purification of Ef-	W76-05540 7B	Eurasian Water-Milfoil in Michigan,
fluents from the Manufacture of Bleached		W76-06149 5G
Bisulfite Pulp by Aeration Lagooning (Etude experimentale de l'epuration par lagunage aere	MATSUYAMA, M. Changes in the Limnological Features of a	MCPARTLAND, J. T.
de liqueurs bisulfitiques de pate de cellulose	Meromictic Lake Suigetsu During the Years,	Field Observations of the Persistence of AgI-
blanchie),	1926-1967,	NH4I-Acetone Ice Nuclei in Daylight,
W76-05718 5D	W76-06018 2H	W76-05677 3B

on el-5D ed

ics als 5B

ou-

2J

in
3F
ion
2J
in
6B
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2L

ters tog-

the non 5C nile resoulp

5C for 5G

ting n in 2F

5G AgI-

3B

MCWHORTER, D. B.	MILLER, R.	Soil Processes and Introduced Chemicals.
Salt Transport in Soil Profiles with Application	An Evaluation of Some Recreational, Demo-	W76-05936 4C
to Irrigation Return Flow, The Dissolution and	graphic and Economic Impacts of Canyon	
Transport of Gypsum in Soils,	Lake,	MORAVEC, F.
W76-05836 5B	W76-05506 6B	On some Problems of the Biological Control of
MECKLENBURG, R.	MILLER, R. W.	Human Schistosomes in Egypt,
Overwintering of Evergreens in Plastic Struc-	Fisheries Research,	W76-06034 5C
tures.	W76-05878 5C	Some Helminths of Bulinus Truncatus and
W76-06014 21		Biomphalaria Alexandrina from the Irrigation
	MILLS, W. R.	System Near Cairo,
MEDVEDEV, M. I.	Water Factory 21 is the Future,	W76-06028 5A
Control of Coagulant Recovery from Effluent	W76-05782 5F	
Sediment (Kontrol' regeneratsii koagulyantov	MIMOTO, N.	MOSS, G. J.
iz osadka ctochnykh vod), W76-05725 5E	Activated Carbon Treatment of Pulp and Paper	Line Motion and Water Current Disc Sensor,
W 70-03723 3E	Waste Water,	W76-05539 7B
MEEHAN, W. R.	W76-05730 5D	MOTZ, A. B.
Comparative Effectiveness of the Standard	MINEAR, A.	Social Science Data Banks and the Institute for
Surber Sampler and a Hydraulic Modification	Impact of Coal Strip Mining on Water Quality	Water Resources.
for Estimating Bottom Fauna Populations,	and Hydrology of East Tennessee,	W76-05822 6B
W76-05613 7B	W76-05833 5B	W 70 03022
Effects of Forest Fertilization on Two	***	MOUNTCASTLE, W. R.
Southeast Alaska Streams,	MIWA, T.	Nature and Stability of Complex Mercury
W76-05612 5C	Desalination Process by Improved Multistage	Compounds in Surface and Ground Waters,
30	Electrodialysis,	Phase II,
MEIDL, J. A.	W76-05980 3A	W76-05838 5A
Filter Cleaning Method,	MIYAMOTO, S.	
W76-05974 5F	Effect of Surface Applied Sulfuric Acid on	MOYER, J. E.
MELICHANOV V A	Water Penetration into Dry Calcareous and	Port Collection and Separation Facilities for
MEL'CHANOV, V. A. Snow Accumulation and Melting in the Forest	Sodic Soils,	Oily Wastes. Vol. 5. A Comparative Analysis of
and in Clear-Cut Areas in the Central Ural,	W76-05907 5G	Conceptual System Plans for the Surveyed
W76-05929 2C		Ports Under the 'No Discharge', '1969 Amend-
11/0-03/2/	MOGG, J. L.	ments' and 'No Sheen' Criteria,
MENHINICK, E. F.	Portable Water Sampling Apparatus,	W76-05830 5D
Plankton Populations,	W76-05958 7B	MUELLER, E. W.
W76-05873 5C	Siphon System Yields Chilean Plant More	Effects of Forest Fertilization on Two
	Water.	Southeast Alaska Streams,
MERCIER, M. A.	W76-05550 8C	W76-05612 5C
Canadian Water Resources Information: A		W 70-05012
Network Approach,	MOLLER, F.	MULLER, F.
W76-05952 10D	The Application of Sequential Estimation	Apparatus for the Separation of Liquid Mix-
MERLIVAT, L.	Methods to Counts of Phytoplankton,	tures My Means of Permeability Selective
Isotopic Study of Hail,	W76-05622 5A	Separation Membranes,
W76-05665 2B	MOLNAR, K.	W76-05991 3A
	On Diplostomosis of the Grasscarp Fry,	
MERRA BAI, B.	W76-06025 2H	MULLER, R. N.
Factors in the Purification of Flowing Sewage		Miami River Watershed Project: Introduction,
and Activated Sludge Process, Part I,	MOLONEY, J. I.	W76-05886 5B
W76-05795 5D	Submerged Air Release Device Particularly for	MURPHY, J. J.
MERRILL, D. T.	Sewage Treatment,	Silver in Photoprocessing Effluents,
Lime-Induced Reactions in Municipal Waste-	W76-05581 5D	W76-05732 5D
waters,	MONTGOMERY, M. L.	W 10-03/32
W76-05597 5D	Dicamba Residues in Streams After Forest	MYERS, E. A.
	Spraying,	Design, Operation, and Monitoring of Mu-
MERSON, M. H.	W76-05949 5B	nicipal Irrigation Systems,
Outbreaks of Waterborne Disease in the United		W76-05783 5E
States, 1971-1972, W76-06138 5C	MOODY, D. W.	
W /0-00138	Application of Multi-Regional Planning Models	NAGY, L.
MEWES, A. R.	to the Scheduling of Large-Scale Water Resource Systems Development,	Technical-Economic Planning of the Gab-
Process for the Treatment of Mineral Slimes,	W76-05846 6A	cikovo-Nagymaros Barrage Project for the
W76-05973 5D	W 70-03040	Development of the Central-Danube Basin, W76-05754
	MOORE, D. G.	W76-05754 4A
MEYER, F. P.	Effects of Forest Fertilization with Urea on	NASH, F. M.
Parasites of Freshwater Fishes. A Review of	Stream Water QualityQuilcene Ranger Dis-	Pollution Control System for Water Supply,
their Control and Treatment,	trict, Washington,	W76-05530 SF
W76-05953 2H	W76-05938 5B	
MIDDLEBROOKS, E. J.	Impact of Forest Fertilization on Water Quality	NASR, M. S.
Biomass Distribution and Kinetics of Baffled	in the Douglas-Fir Region - A Summary of	Lab-Proven Fly Ash Process Removes Bleach
Lagoons,	Monitoring Studies,	Effluent Color,
W76-05590 5D	W76-05943 5B	W76-05707 5D
		NATMEDN C
MIGNONE, N. A.	The Impact of Timber Harvest, Fertilization,	NAZNEEN, S.
Engineers Can Exert Process Control Over	and Herbicide Treatment on Streamwater	Seasonal Distribution of Phytoplankton in Kinj-
Digester Inputs, W76-05807 5D	Quality in Western Oregon and Washington,	har (Kalri) Lake, W76-06146 SC
11 /0-0360/	W76-05618 5B	H 10-00140

AUTHOR INDEX

PAS V PAS F

PA

PA

PA

P

PI

PI

P

P

	**			-
N	68	Ð	IA,	G.

NEBBIA, G.	The Impact of Timber Harvest, Fertilization,	OZAKI, H.
Detailed Economic Models for Industrial and Other Activities,	and Herbicide Treatment on Streamwater Quality in Western Oregon and Washington, W76-05618 5B	Effect of the Operational Temperature in Reverse Osmosis Method (Gyaku shinto ho ni
W76-05817 5G		okeru sosa ondo no eikyo), W76-05592
NEELY, W. P.	Pesticide Residue Dynamics in a Forest	
A Portfolio Approach to Public Water Project	Ecosystem: A Compartment Model, W76-05946 5B	PAGE, J. C. Apparatus for the Treatment of Liquid Wastes,
Decision Making, W76-05995 6B		W76-05967 5D
	Soil Processes and Introduced Chemicals,	I I I I I I I I I I I I I I I I I I I
NELSON, D. M.	W76-05936 4C	PAN'KOVA, I. M. Productivity and Biochemical Composition of
The Chemical Speciation of PU-239, PU-240 and CS-137 in Lake Michigan Waters,	NORTH, R. M.	Chlorella at Different Levels of Illumination
W76-05889 5B	A Portfolio Approach to Public Water Project	and Nitrogen Limitation,
Effect of Mariainal Transaction Processes	Decision Making, W76-05995 6B	W76-05640 5C
Effect of Municipal Treatment Processes on PU-239, PU-240, and CS-137,		PANDIAN, T. J.
W76-05890 5F	NUTBROWN, D. A. Normal Mode Analysis of the Linear Equation	Effect of Running Water on the Predatory Effi-
NEI CON H	of Groundwater Flow,	ciency of the Larvivorous Fish Cambusia Af-
NELSON, H. Late Pleistocene and Holocene Depositional	W76-05685 2F	finis, W76-06021 2!
Trends, Processes, and History of Astoria	OBAYASHI, A. W.	
Deep-Sea Fan, Northeast Pacific,	Biological Nitrification of Sludge Supernatant	PAPACOSTA, C. G.
W76-05845 2L	by Rotating Disks,	Port Collection and Separation Facilities for Oily Wastes. Vol. 5. A Comparative Analysis of
NESBEITT, W. D.	W76-05800 5D	Conceptual System Plans for the Surveyed
PVC Pipe in Water Distribution: Reliability and	OBRO, H.	Ports Under the 'No Discharge', '1969 Amend-
Durability,	Groundwater Study of a Volcanic Area Near	ments' and 'No Sheen' Criteria,
W76-05552 8G	Bandung, Java, Indonesia,	W76-05830 5D
NEWTON, D. W.	W76-05914 4B	PARAMESWARAN, V. R.
Interactions of Mercury with Aquatic and	OGDEN, J. C.	Brittle Fracture of Ice at 77 K,
Edaphic Environments, W76-05601 5B	Relation of Water Level and Fish Availability	W76-05673 2C
11.10-03001	to Wood Stork Reproduction in the Southern Everglades, Florida,	PAREN, J. G.
NICHOLSON, R. W.	W76-05850 2I	Internal Reflections in Polar Ice Sheets,
Simple Procedures Can Help Reduce Drill Pipe	OGUNKANMI, A. B.	W76-05681 2C
Damage, W76-05572 8C	Detection and Preliminary Identification of En-	PARKER, B. C.
	dogenous Antitranspirants in Water-Stressed	Microbiological and Chemical Enrichment of
NICOLAS, C.	Sorghum Plants,	Freshwater-Surface Microlayers Relative to the Bulk-Subsurface Water,
Contamination of Freshwater by Mn54 and Co60,	W76-06026 2I	W76-06124 5C
W76-05903 5C	OKAJIMA, Y.	
NIEL CENT B	Method of Preventing Scale From Being Deposited In Case of Producing Fresh Water	PARKER, D. S. Lime Recovery and Reuse in Primary Treat-
NIELSEN, P. Chemical Precipitation of Wastewaters with	From Sea Water,	ment,
Lime (Kemisk fallning av avloppsvatten med	W76-05971 3A	W76-05785 5D
kalk),	OKLAND, K. A.	Lime Use in Wastewater Treatment: Design
W76-05585 5D	Macrovegetation and Ecological Factors in	and Cost Data,
NIELSON, S. B.	Two Norwegian Lakes,	W76-05868 5D
Biomass Distribution and Kinetics of Baffled	W76-06044 5C	PARKER, J. I.
Lagoons,	ORHUN, A.	Distribution of Amorphous, Diatom Frustule,
W76-05590 5D	Coupled Saturated-Unsaturated Transient Flow	and Dissolved Silica in a Lead-210 Dated Core
NIEMISTO,	in Porous Media: Experimental and Numeric Model,	from Southern Lake Michigan, W76-05883 5C
Examination and Removal of Iron in Ground-	W76-05684 2F	W 70-03883
water, W76-05571 5B		Distribution of Diatom Frustules in Lake
	ORLANDINI, K. A. The Chemical Speciation of PU-239, PU-240	Michigan Sediment Cores, W76-05882 5C
NIFUKU, M.	and CS-137 in Lake Michigan Waters,	
Detachment of Pendant Water Drops by High Voltage Pulses,	W76-05889 5B	Role of Copepod Fecal Pellets in the Vertical
W76-05917 2B	ORLOCZI, I.	Transport of Freshwater Diatoms, W76-05880 5C
	Water Resources Development in the Tisza	
NIKOLAYEVA, G. M. Maps of the Elements of the Hydrologic	River Basin and Its Impact on Socio-Economic	Vertical Transport of Particulate Material in
Budget of Asia,	Growth, W76-05519 4A	Lake Michigan by the Lorica of Codonella Cratera,
W76-05934 2A		W76-05881 5C
NORRIS, L. A.	ORNES, W. H.	
Dicamba Residues in Streams After Forest	Phosphorus Removal from Static Sewage Ef- fluent Using Duckweed,	PARSONS, D. A. Discharge Equations for HS, H, and HL
Spraying,	W76-05775 5D	Flumes,
W76-05949 5B	OSTERKAMP, T. E.	W76-05918 8B
Effect of Cacodylic Acid and MSMA on	Nucleation Characteristics of Stream Water	PARSONS, G. L.
Microbes in Forest Floor and Soil,	and Frazil Ice Nucleation,	Filtering Apparatus and Process,
W76-05940 5C	W76-05695	W76-05546 SD

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HL
8B

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PARTHASARATHY, B.	PETERSON, W. A.	PRIHAR, S. S.
Trend Analysis of Annual Indian Rainfall,	Awt Plant is Top Performer,	Effect of Depth and Salinity of Ground Water
W76-05691 2B	W76-05769 5D	
PASZTO, P.	PETR, T.	W76-06036 2D
Recent Trends in Water Quality Management	Dynamics of Benthic Invertebrates in a Tropi-	PROSDOCIMO, G.
and Protection in Hungary,	cal Man Made Lake (Volta Lake 1964-1968):	Water Line,
W76-05518 5G	Standing Crop and Bathymetric Distribution,	W76-05541 3F
	W76-06144 5C	
PATERSON, C. G.		PULAWSKI, B.
Seasonal Dynamics and Productivity of Tany-	PETROU, B. N.	Groundwater Study of a Volcanic Area Near
tarsus Barbitarsis Freeman	The Economics of Alternative Deep Seabed	Bandung, Java, Indonesia,
(Diptera:Chironomidae) in the Benthos of a	Regimes,	W76-05914 4B
Shallow, Saline Lake,	W76-05816 6E	BARKS I II
W76-06142 5C	NUMBER OF B	RAINS, J. H.
PATNAIK, S.	PIERCE, F. D.	Macrobenthic Population Dynamics in Indiana
Observations on the Seasonal Fluctuations of	An Automated Technique for the Sub-Micro-	Waters of Lake Michigan in 1970, W76-05623
Plankton in the Chilka Lake,	gram Determination of Selenium and Arsenic in	W 10-03023
W76-06118 · 2H	Surface Waters by Atomic Absorption Spec- troscopy,	RALSTON, P. H.
11 70-00110	W76-05736 5A	Inhibition of Scale Deposition,
PATRICK, J. M. JR.	W 10-05150	W76-05529 5D
Mirex Residues in Selected Estuaries of South	PIET, G. J.	
Carolina: June 1972,	Cause and Identification of Taste and Odour	RAMSEY, J. S.
W76-05954 5A	Compounds in Water,	Food Habits of the Rough Shiner, Notropis
	W76-06009 5A	Baileyi Suttkus and Raney, in Halawakee
PAULEKAT, F.		Creek, Alabama,
Cathodic Inner and Outer Protection for a Dou-	PILLAI, S. C.	W76-06126 2
ble Syphon for Waste Water (Kathodischer	Factors in the Purification of Flowing Sewage	P. C. P. L. C.
Innen-und Aussenschutz Fuer Einen Abwasser-	and Activated Sludge Process, Part I,	RAO, RAMACHANDRA T.
Doppeldueker),	W76-05795 5D	Breeding Places and Seasonal Incidence of
W76-05584 5D		Aedes Aegypti, as Assessed by the Single-
DAULE C. P.	PLATE, E. J.	Larva Survey Method, W76-06033 5G
PAULS, C. F.	Simulation as a Tool in International River	W /0-00033
Wastewater Treatment Evaluation, Mather Air	Development,	RAPPAZ, A.
Force Base, California, W76-05801 5D	W76-05757 6A	Apparatus for the Treatment of Liquid Wastes,
W76-05801 5D	PLECNAC, V.	W76-05967 5D
Wastewater Treatment Evaluation, Mt. Hebo	The Czechoslovak Water Development	11.003307
Air Force Station, Oregon,	Planning Approach and Its Application,	RATH, A.
W76-05802 5D	W76-05749 6A	An Identification Approach to Subsurface
11 70 03002	W 70-03749	Hydrological Systems,
PAULSEN, G. W.	POGGE, E. C.	W76-05688 2F
Interactions of Mercury with Aquatic and	Development and Field Testing of a Basin	
Edaphic Environments,	Hydrology Simulator,	RAYMOND, C. F.
W76-05601 5B	W76-05745 2A	Some Observations on the Behavior of the
		Liquid and Gas Phases in Temperate Glacier
PAULSON, R. E.	PONCE, S. L.	Ice,
Portable Water Sampling Apparatus,	Demand for Dissolved Oxygen Exerted by	W76-05915 20
W76-05958 7B	Finely Divided Logging Debris in Streams,	DECHED H P
BEIDANO Y E	W76-05939 4C	RECHER, H. F.
PEIRANO, L. E.	BOBBOTTI E	The Fauna of Careel Bay with Comments on the Ecology of Mangrove and Sea-Grass Com-
Low Cost Phosphorous Removal,	PORROZZI, E.	munities.
W76-05786 5D	Biological Treatment by a System of Activated	W76-06022 2L
PELTIER, W. R.	Sludge Applied to the Effluent Waters of a	W 70-00022 21
Collapse of the Hudson Bay Ice Center and	Corrugated Board Plant, W76-05713 5D	RECTOR, N. H.
Glacio-Isostatic Rebound,	W /6-03/13 3D	Water Level Gauge,
W76-05669 2C	Influence of Temperature on Biological Purifi-	W76-05977 7E
	cation of Paper Mill Effluent (Influenza della	
PERLMUTTER, N. M.	temperatura sulla depurazione biologica di un	REDDY, S. RAVICHANDRA
Hydrogeochemical Data from Investigation of	refluo di cartiera),	Effect of Running Water on the Predatory Effi
Water Quality in Sewered and Unsewered	W76-05700 5D	ciency of the Larvivorous Fish Cambusia Af
Areas, Southern Nassau County, Long Island,		finis,
New York,	PREPEJCHAL, W.	W76-06021 2
W76-05858 7C	Characteristics of Temperature-Sensitive Fish	REE, W. O.
BEBONOVI I I	Tags Used in 1974,	Dependable Yield of Reservoirs with Intermit
PERSINSKI, L. J.	W76-05897 5C	tent Inflows,
Inhibition of Scale Deposition,	Developments in Underwater Radiotelemetry	W76-05908 4A
W76-05529 5D	and Preliminary Fish Tracking in Thermal	47
PETERS, H. T.	Plumes,	REED, L. A.
Nature and Stability of Complex Mercury	W76-05893 5C	Sediment Characteristics of Five Streams Near
Compounds in Surface and Ground Waters,	11 /0-03033 3C	Harrisburg, Pennsylvania, Before Highway
Phase II,	Discharge Residence of TLD Tagged Fish,	Construction,
W76-05838 5A	W76-05898 5C	W76-05854 40
PETERSON, C. E.	Effects of Season, Location, and Discharge	REEVE, C. A.
Removal of Immiscible Fluids from Water Sur-	Type on Fish Distribution and Density in Ther-	Sedimentary Pu-239, Pu-240 Phase Distribu
faces and Lake Beds,	mal Plumes,	tions in Lake Michigan Sediments,
W76-05984 5G	W76-05896 5C	W76-05891 5E

AUTHOR INDEX

REICHMUTH, B. J.

REICHMUTH, B. J. Air Rotary Drilling with Organic Polymers Of-	Effects of Season, Location, and Discharge Type on Fish Distribution and Density in Ther-	SALAMIN, A. Water Management Control System for the
fers Many Benefits, W76-05562 8B	mal Plumes, W76-05896 5C	Zagyva-Tarna River Basin, W76-05746 4A
RENBERG, L.	Origin of Fin-Clipped Salmonids Collected at	SALISBURY, F. B.
Ion Exchange Technique for the Determination of Chlorinated Phenols and Phenoxy Acids in	Two Thermal Discharges on Lake Michigan, W76-05895 5C	Plant Development Under Snow, W76-06147 21
Organic Tissue, Soil, and Water,	DOCEMBERG B	SALTER, S. H.
W76-06122 5A	ROSENBERG, R.	Apparatus and Method for Extracting Wave
BENNOTES T.	Spatial Dispersion of an Estuarine Benthic Fau-	Energy,
REYNOLDS, J. H.	nal Community,	
Biomass Distribution and Kinetics of Baffled	W76-06040 2L	W76-05538 8C
Lagoons,		SAMPAYO, F. F.
W76-05590 5D	ROSS, R. N.	Supernatant Doesn't Have to Ruin Effluent
	Timber Production and Water Quality	•
RHODES, A. C.	Progress in Planning for the Bull Run, Portland,	Quality,
The Influence of Dissolved Oxygen Concentra-	Oregon's Municipal Watershed,	W76-05772 5D
tions on Three Species on Water Mites	W76-05942 5B	SAVALAPPAN, K. N.
(Hydracarina),		Tertiary Treatment Plant for Multistoried
W76-06133 5C	ROTH, E.	
	Isotopic Study of Hail,	Building, W76-05789 5D
RIEWE, R. W.	W76-05665 2B	W76-05789 5D
A Driller's Good Friend - The Electric Logger,	11.0 00000	SAWYER, B. M.
W76-05561 8G	ROTHACHER, J.	
	Soil Stability and Water Yield and Quality,	Biological Nitrification of Sludge Supernatant
RITCHIE, J. C.		by Rotating Disks,
Fallout CS-137: A Tool in Conservation	W76-05937 4D	W76-05800 5D
Research,	DOUBL .	20171171
W76-05690 2J	ROUBA, J.	SCARLATA, V.
	Processing of Sediments from Coagulation Ap-	Biological Treatment by a System of Activated
ROBBINS, J. A.	plied as the Third Stage of Effluent Purification	Sludge Applied to the Effluent Waters of a
Distribution of Amorphous, Diatom Frustule,	(Przerabianie osadow powstajacych przy	Corrugated Board Plant,
and Dissolved Silica in a Lead-210 Dated Core	zastosowaniu koagulacji jako trzeciego stopnia	W76-05713 5D
from Southern Lake Michigan,	oczyszczania sciekow z przemyslu wlokiennic-	
W76-05883 5C	zego),	Influence of Temperature on Biological Purifi-
W 70-03863	W76-05697 5D	cation of Paper Mill Effluent (Influenza della
Geochronology of Lake Michigan Sediments:	W 70-03077	temperatura sulla depurazione biologica di un
Anomalies in Lead-210 Distributions.	RUSCOMBE-KING, N. J.	refluo di cartiera),
	Sludge Dewatering Trials at Banbury,	W76-05700 5D
W76-05885 5B		
Stable Lead Gasabranalass of Fire Grained	W76-05809 5D	SCHAER, F.
Stable Lead Geochronology of Fine-Grained	DUCHTON P D	Technical-Economic Product Design as
Sediments in Southern Lake Michigan,	RUSHTON, K. R.	Typified by a Sewage Pumping Installation,
W76-05884 5B	Pumping-Test Analysis Using a Discrete Time-	W76-05591 5D
BORIN C DE O	Discrete Space Numerical Method,	
ROBIN, G.DE Q.	W76-05913 4B	SCHAFFER, R. C.
Internal Reflections in Polar Ice Sheets,		Sociological Analysis of Dam Impact: A Study
W76-05681 2C	RYAZANSKIY, G. G.	of Twenty-Two Large Dams in Texas,
ROBITAILLE, R.	Alignment of Longitudinally Aerating Aeration	W76-05501 6B
	Tanks (Naladka aerotankov prodlennoy aerat-	
Correction of Bias in the Estimation of the	sii),	SCHAPP, H.
Coefficient of Skewness,	W76-05587 5D	Cathodic Inner and Outer Protection for a Dou-
W76-05910 2E		ble Syphon for Waste Water (Kathodischer
	RYSAVY, B.	Innen-und Aussenschutz Fuer Einen Abwasser-
ROCK, J. F.	On some Problems of the Biological Control of	Doppeldueker),
The Indigenous Trees of the Hawaiian Islands,	Human Schistosomes in Egypt,	W76-05584 5D
W76-06005 2I	W76-06034 5C	
		SCHAPPERT, H. J. V.
ROGER, F.	Some Helminths of Bulinus Truncatus and	Carbon Dioxide Evolution from Virgin and Cul-
Application of Factorial Analysis of Principal	Biomphalaria Alexandrina from the Irrigation	tivated Soil as Affected by Management Prac-
Components to the Control of Pollution of Sur-	System Near Cairo.	tices and Climate,
face Waters,	W76-06028 5A	W76-06003 2G
W76-05632 5B	11 / 5-00020 3A	
	SABET, A.	SCHNEIDER, H.
Evaluation of Surface Water Pollution at	Vertical Electrical Resistivity Soundings to	Trace Element, Mineralogy, and Size Distribu-
Several Points in Relation to Zones of Shellfish		tion of Suspended Material Samples from
Industry in Roadsteads of the Brest Region, (In	Locate Ground Water Resources: A Feasibility	Selected Rivers in Eastern Kansas,
French),	Study,	W76-05606 5B
W76-06150 5B	W76-05835 4B	
	CAVCENA N.C.	SCHREURS, R. L.
ROMBERG, G. P.	SAKSENA, N. C.	Efficient Wells Save Energy and Reduce Costs,
Characteristics of Temperature-Sensitive Fish	Water Resources Development in the Ganga-	W76-05563 4B
Tags Used in 1974,	Ghagra Interbasin in Uttar Pradesh (India),	
W76-05897 5C	W76-05763 4A	Use of Formation Stabilizer - A Valuable
30		Technique,
Comparison of the Movement and Recapture of	SALAMA, G.	W76-05564 8A
Salmonid Fishes Tagged at Two Power Plants,	Evaluation of Surface Water Pollution at	6A
W76-05894 5C	Several Points in Relation to Zones of Shellfish	SCHROEDER, H. J. JR.
30	Industry in Roadsteads of the Brest Region, (In	Pesticide Residue Dynamics in a Forest
Discharge Residence of TLD Tagged Fish,	French),	Ecosystem: A Compartment Model,
	W76-06150 5B	W76-05946 5B
W76-05898 5C		

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	SEWELL, W. R. D.	SIMMONS, C. E.
Removal of Detergent Fluorescent Whitening	Flood Loss Management in Developing Coun-	Sediment Characteristics of Streams in the
Agents from Waste Water, W76-05804 5D	tries: A Model for Identifying Appropriate Strategies,	Eastern Piedmont and Western Coastal Plain Regions of North Carolina,
	W76-05761 6A	W76-05849 2J
SCHWEIZER, G.	CPVMOUB P V	CIMMONS D
Experiments on the Optimization of Sludge De- watering and on the Use of Bark and Sludge in	SEYMOUR, E. V. Removal of Floating Pollutants,	SIMMONS, D. The Fate of Nutrients in Back River,
the Brick Industry (Versuche Zur Optimierung	W76-05533 5G	W76-05625 5C
der Schlammentwaesserung und zur Verwer-		
tung von Rinde und Schlamm in der Ziegelin-	SHAMIR, U. Forecasting Water Levels in Aquifers by Nu-	SINGLETON, F. D. An Economic Model of Water Use and Waste
dustrie), W76-05704 5D	merical and Semihybrid Methods,	Treatment,
W 70-03704	W76-05686 2F	W76-05814 5D
SCOTT, R. H.	SHANNON, L. R.	SINKULE, C.
Status of Water Pollution Control in the Soviet Union,	Accumulation and Elimination of Dieldrin by	Nature and Stability of Complex Mercury
W76-05714 5G	Channel Catfish (Ictalurus Punctatus),	Compounds in Surface and Ground Waters,
	W76-05642 5C	Phase II,
SCUDDER, T. Social Impacts of Integrated River Basin	SHARMA, D. R.	W76-05838 5A
Development on Local Populations,	Effect of Depth and Salinity of Ground Water	SIROKI, M.
W76-05755 6A	on Evaporation and Soil Salinization,	Extraction - Visible Spectrophotometric
CPOURT I	W76-06036 2D	Method for Determination of Nitrate: Applica-
SECHET, J. Experimental Study of the Purification of Ef-	SHELLEY, P. E.	tion to Water Analysis, W76-05717 5A
fluents from the Manufacture of Bleached	An Assessment of Automatic Sewer Flow Sam-	***************************************
Bisulfite Pulp by Aeration Lagooning (Etude	plers - 1975,	SKAKAL'SKIY, B. G.
experimentale de l'epuration par lagunage aere	W76-05864 5D	Effect of Urbanization on the Quality of River Water,
de liqueurs bisulfitiques de pate de cellulose blanchie),	Sewer Flow Measurement - A State-Of-The-Art	W76-05926 5B
W76-05718 5D	Assessment,	
	W76-05865 5D	SKELTON, J.
SEGOL, G.	SHEMA, B. F.	The 1973 Mississippi River Basin Flood: Com- pilation and Analyses of Meteorologic, Stream-
Finite Element Mesh Gradation for Surface Waves,	Synergistic Compositions Containing 2,2-	flow, and Sediment Data,
W76-05919 8E	Dibromo-3-Nitrilopropionamide and 3,3,4,4-	W76-05860 2E
	Tetrachlorotetrahydro-Thiopene-1,1-Dioxide	SLOAN B I
SEIBEL, E. Lake and Shore Ice Conditions on Southeast-	and Their Use, W76-05531 5F	SLOAN, B. J. Awt Plant is Top Performer,
ern Lake Michigan in the Vicinity of the	W 10-05551	W76-05769 5D
Donald C. Cook Nuclear Plant: Winter 1973-74,	SHESTAKOV, F. V.	SLY, W. K.
W76-05664 2C	Classification of Methods of Groundwater Management (Klassificaksiiya metodov	Ratio Between Evapotranspiration from
SEICHTER, P.	upravleniya rezhimom i resursami podzemnykh	Lysimeters and Evaporation from Small
Study of Turbine Mixers for Flow-Through	vod),	Evaporimeters Using 2- and 3- hour Periods of
Flocculation Chambers (Vyzkum turbinovych	W76-05600 4B	Measurement, W76-06029 2D
michadel pro prutocne flokulacni komory),		W 70-00029
michadel pro prutocne flokulacni komory), W76-05703 5D	SHIELDS, M. A. Social Impact Assessment: An Analytic	SMART, R. E.
W76-05703 5D SEKI, T.	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography,	SMART, R. E. Grapevine Response to Furrow and Trickle Ir-
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Ad-	SHIELDS, M. A. Social Impact Assessment: An Analytic	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation,
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon,	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B	SMART, R. E. Grapevine Response to Furrow and Trickle Ir-
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Ad-	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography,	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F SMIRNOVA, L. N.
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P.	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings,	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photo-	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings,	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Amer-	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 5A
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum,	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 5A SMIT, G.
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M.	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Amer-	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E.	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivot- niho prostredi pri pouzivani skrobovych
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake,	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 5A SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivotniho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu),
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance,	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 3F SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivot- niho prostredi pri pouzivani skrobovych
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake,	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivotniho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J.
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 6B SEPPANEN, H. Examination and Removal of Iron in Ground-	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M.	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivotniho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Suc-
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 6B SEPPANEN, H. Examination and Removal of Iron in Groundwater,	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M. Sludge Dewatering Trials at Banbury,	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivot- niho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Suc-
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 6B SEPPANEN, H. Examination and Removal of Iron in Ground-	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M.	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivotniho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Successful Wells, W76-05565 8C
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 6B SEPPANEN, H. Examination and Removal of Iron in Groundwater, W76-05571 5B SERRUYA, C.	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M. Sludge Dewatering Trials at Banbury, W76-05809 5D SIEWERT, W. H.	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivot- niho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Suc- cessful Wells, W76-05565 SMITH, D. W.
W76-05703 SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 SEPPANEN, H. Examination and Removal of Iron in Groundwater, W76-05571 SERRUYA, C. Phosphorus, Nitrogen, and the Growth of	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M. Sludge Dewatering Trials at Banbury, W76-05809 5D SIEWERT, W. H. Escher-Wyss Flotation Cells for Clarification	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivotniho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Successful Wells, W76-05565 SMITH, D. W. Growth of Plume Resident Fishes in Lake
W76-05703 5D SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 5D SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 5E SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 6B SEPPANEN, H. Examination and Removal of Iron in Groundwater, W76-05571 5B SERRUYA, C. Phosphorus, Nitrogen, and the Growth of Algae in Lake Kinneret,	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M. Sludge Dewatering Trials at Banbury, W76-05809 5D SIEWERT, W. H. Escher-Wyss Flotation Cells for Clarification and Cleaning (Die Escher-Wyss Flotationszel-	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivot- niho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Suc- cessful Wells, W76-05565 SMITH, D. W.
W76-05703 SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 SEPPANEN, H. Examination and Removal of Iron in Groundwater, W76-05571 SERRUYA, C. Phosphorus, Nitrogen, and the Growth of Algae in Lake Kinneret, W76-05633 SC	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M. Sludge Dewatering Trials at Banbury, W76-05809 5D SIEWERT, W. H. Escher-Wyss Flotation Cells for Clarification	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivotniho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Successful Wells, W76-05565 SMITH, D. W. Growth of Plume Resident Fishes in Lake Michigan, W76-05901 SC
W76-05703 SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 SEPPANEN, H. Examination and Removal of Iron in Groundwater, W76-05571 SERRUYA, C. Phosphorus, Nitrogen, and the Growth of Algae in Lake Kinneret, W76-05633 SETSER, J. L.	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M. Sludge Dewatering Trials at Banbury, W76-05809 5D SIEWERT, W. H. Escher-Wyss Flotation Cells for Clarification and Cleaning (Die Escher-Wyss Flotationszellen zur Klaerung und Reinigung), W76-05723 5D	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivot- niho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Suc- cessful Wells, W76-05565 SMITH, D. W. Growth of Plume Resident Fishes in Lake Michigan, W76-05901 SMITH, J. W.
W76-05703 SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 SEPPANEN, H. Examination and Removal of Iron in Groundwater, W76-05571 SERRUYA, C. Phosphorus, Nitrogen, and the Growth of Algae in Lake Kinneret, W76-05633 SETSER, J. L. Process and Equipment for Automatic Chemi-	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M. Sludge Dewatering Trials at Banbury, W76-05809 5D SIEWERT, W. H. Escher-Wyss Flotation Cells for Clarification and Cleaning (Die Escher-Wyss Flotationszellen zur Klaerung und Reinigung), W76-05723 5D SIMKOWSKI, N. A.	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivotniho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05720 SMITH, A. J. Proper Selection of Gravel Pack is Key to Successful Wells, W76-05565 SMITH, D. W. Growth of Plume Resident Fishes in Lake Michigan, W76-05901 SC
W76-05703 SEKI, T. Method of Treatment of Sludges With Size-Adjusted Carbon, W76-05985 SEMENOV, V. P. Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod), W76-05725 SEMINARA, M. An Evaluation of Some Recreational, Demographic and Economic Impacts of Canyon Lake, W76-05506 SEPPANEN, H. Examination and Removal of Iron in Groundwater, W76-05571 SERRUYA, C. Phosphorus, Nitrogen, and the Growth of Algae in Lake Kinneret, W76-05633 SETSER, J. L.	SHIELDS, M. A. Social Impact Assessment: An Analytic Bibliography, W76-05820 6B SHIMAMURA, I. Method of Treating Waste Liquids from Photographic Processings, W76-05963 5D SHOLL, R. D. The Microenvironment of Climacium Americanum, W76-06045 2G SHRIVER, L. E. Operational Practices to Upgrade Trickling Filter Plant Performance, W76-05781 5D SIDWICK, J. M. Sludge Dewatering Trials at Banbury, W76-05809 5D SIEWERT, W. H. Escher-Wyss Flotation Cells for Clarification and Cleaning (Die Escher-Wyss Flotationszellen zur Klaerung und Reinigung), W76-05723 5D	SMART, R. E. Grapevine Response to Furrow and Trickle Irrigation, W76-06032 SMIRNOVA, L. N. Rapid Determination of the Cod of Effluents (Uskorennoe opredelenie KhPK stochnykh vod), W76-05705 SMIT, G. Environmental Aspects of the Use of Starches in the Paper Industry (Hlediska ochrany zivot- niho prostredi pri pouzivani skrobovych produktu v papirenskem prumyslu), W76-05700 SMITH, A. J. Proper Selection of Gravel Pack is Key to Suc- cessful Wells, W76-05565 SMITH, D. W. Growth of Plume Resident Fishes in Lake Michigan, W76-05901 SC SMITH, J. W. Interim Report on the Impact of Public Law 92-

SWAN
The
Soil

Gui ble Nat W7

Inte Mar W7 Ros Nor mer W7

SMITH, M. H.	Effects of Season, Location, and Discharge	STOWERS, K. L.
Process for the Treatment of Mineral Slimes,	Type on Fish Distribution and Density in Ther-	Effect of Cacodylic Acid and MSMA on
W76-05973 5D	mal Plumes, W76-05896 5C	Microbes in Forest Floor and Soil, W76-05940 5C
SMITH, P. E.	W 70-03890	W 70-03940
Process for Biochemical Reactions,	Growth of Plume Resident Fishes in Lake	STRAUMSNES, O. R.
W76-05542 5D	Michigan,	Water Current Power Generator System,
	W76-05901 5C	W76-05537 8C
SMITH, R. A.	Origin of Fin-Clipped Salmonids Collected at	STRIBLING, J. C.
Primary Production,	Two Thermal Discharges on Lake Michigan,	An Evaluation of Some Recreational, Demo-
W76-05874 5C	W76-05895 5C	graphic and Economic Impacts of Canyon
SMITH, W. E.		Lake,
Comparative Toxicity of Polyelectrolytes to	SPIZZICHINO, G.	W76-05506 6B
Selected Aquatic Animals,	Multistage Flash Evaporator for Producing Soft	STROEHLEIN, J. L.
W76-05740 5C	Water from a Saline Water,	Effect of Surface Applied Sulfuric Acid on
CNVDPB B P	W76-05978 3A	Water Penetration into Dry Calcareous and
SNYDER, R. E. How Steam Is Produced and Handled at the	SPRUGEL, D. G.	Sodic Soils,
Geysers,	Miami River Watershed Project: Introduction,	W76-05907 5G
W76-05574 8C	W76-05886 5B	STRZELCZYK, E.
11 10 03314		Generic Composition and Nutritional Require-
SNYDER, W. M.	SREENIVASAN, A.	ments of Bacteria Isolated from Three Lakes,
Continuous Seasonal Probability of Extreme	Limnological Features of a Tropical Impound-	W76-06120 2H
Rainfall Events,	ment, Bhavanisagar Reservoir (Tamil Nadu),	CTUADE I I
W76-05692 2B	India, W76-06020 5C	STUART, L. I. Social Assessment Manual: A Guide to the
SOCHAN, P.	W76-06020 5C	Preparation of the Social Well Being Account,
Hydraulic Load Fluctuation in Effluent Treat-	SRINATH, E. G.	W76-05993 6B
ment Plants (Hydraulicke narazy na sedimen-	Factors in the Purification of Flowing Sewage	
tacni cistirny odpadnich vod),	and Activated Sludge Process, Part I,	STYRON, R. W.
W76-05699 5D	W76-05795 5D	Process for the Treatment of Mineral Slimes,
		W76-05973 5D
SOUTJESDIJK, P. G.	STAMBAUGH, J. W.	SUDOL'SKIY, A. S.
Environmental Aspects of the Use of Starches	An Ichthyofaunal Survey and Discussion of	Estimate of the Rate of Turbulent Mixing of
in the Paper Industry (Hlediska ochrany zivot-	Fish Species Diversity as an Indicator of Water	the Fluid in Wind-Driven Currents from the
niho prostredi pri pouzivani skrobovych	Quality, Codorus Creek Drainage, York County, Pennsylvania.	Results of Moving and Still Particle Photog-
produktu v papirenskem prumyslu), W76-05720 5B	W76-05634 5A	raphy,
W76-05720 5B	W 70-03034	W76-05932 8B
SPAIN, A. V.	STANFORD, C.	SUGANO, I.
Effects of a Tropical Cyclone on Littoral and	Development and Field Testing of a Basin	Method of Extracting Heavy Metals from In-
Sub-Littoral Biotic Communities and on a	Hydrology Simulator,	dustrial Waste Waters,
Population of Dugongs (Dugong Dugon	W76-05745 2A	W76-05966 5D
(Muller)),	STANISI AWSVA I	SUGAWARA, M.
W76-06131 2L	STANISLAWSKA, J. Limnological Character of Experimental Reser-	Effect of the Operational Temperature in
SPEALMAN, M. L.	voirs Treated with Tritox 30% (DDT, DMDT,	Reverse Osmosis Method (Gyaku shinto ho ni
Lime Use in Wastewater Treatment: Design	GAMMA HCH),	okeru sosa ondo no eikyo),
and Cost Data,	W76-06012 5C	W76-05592 5D
W76-05868 5D		SULLIVAN, R. A.
	STEFANAC, Z.	Method for the Primary and Secondary Treat-
SPENCER, J. F. T.	Extraction - Visible Spectrophotometric	ment of Wastewater in a Unitary Apparatus,
Yeasts Isolated from Some Lakes and Rivers	Method for Determination of Nitrate: Applica-	W76-05972 5D
of Saskatchewan,	tion to Water Analysis, W76-05717 SA	
W76-06135 5B	W76-05717 5A	SUNDBY, B.
SPEWAK, P.	STEIN, M. E.	Trace Metals in the Waters of the Gulf of St. Lawrence,
Impacts of Hydrologic Modification on Water	Rehabilitating an 80-Year Old Sewer System.	W76-06024 5A
Quality,	W76-05764 5D	3A
W76-05866 5G		SUPER, A. B.
	STENQUIST, R. J.	Field Observations of the Persistence of AgI-
SPIGARELLI, S. A.	Lime Use in Wastewater Treatment: Design	NH4I-Acetone Ice Nuclei in Daylight,
Body Temperature Change Characteristics of	and Cost Data, W76-05868 5D	W76-05677 3B
Lake Michigan Fishes,	W76-05868 5D	SUSCHNY, O.
W76-05899 5C	STENSBY, P. S.	The Reliability of Mercury Analysis in En-
Body Temperatures of Fish Feeding in The	Removal of Detergent Fluorescent Whitening	vironmental Materials,
Point Beach Thermal Discharge,	Agents from Waste Water,	W76-06007 5A
W76-05900 5C	W76-05804 5D	SUTTON, D. L.
	CHONE D. I	Phosphorus Removal from Static Sewage Ef-
Developments in Underwater Radiotelemetry	STONE, D. L.	fluent Using Duckweed,
and Preliminary Fish Tracking in Thermal Plumes.	Silver in Photoprocessing Effluents, W76-05732 5D	W76-05775 5D
	W76-05732 5D	CWANCON E I
W76-05893 5C	STONE, L. R.	SWANSON, F. J. Geology and Geomorphology of the H. J. An-
Effect of Plume Residence on the Accumula-	Water Movement Within the Root Zone of Ir-	drews Experimental Forest, Western Cascades,
tion of Cs137 by Lake Michigan Salmonids,	rigated and Nonirrigated Grain Sorghum,	Oregon,
W76-05902 5C	W76-05994 2G	W76-05941 4D

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A f-

Impact of Clear-Cutting and Road Construction	Regional Water Exchange for Drought Allevia-	TKACHUK, V. P.
on Soil Erosion by Landslides in the Western	tion, W76-05819 4A	Control of Coagulant Recovery from Effluent
Cascade Range, Oregon, W76-05614 4C	W76-05819 4A	Sediment (Kontrol' regeneratsii koagulyantov iz osadka ctochnykh vod),
	TANNO, K.	W76-05725 SE
SWANSTON, D. N.	Method of Preventing Scale From Being	
The Forest Ecosystem of Southeast Alaska 5.	Deposited In Case of Producing Fresh Water	TODINI, E.
Soil Mass Movement, W76-05950 4D	From Sea Water,	Comment Upon Multivariate Synthetic
W76-05950 4D	W76-05971 3A	Hydrology,
Guidelines for Characterizing Naturally Unsta-	TAO P C	W76-05909 2A
ble or Potentially Unstable Slopes on Western	TAO, F. S.	TODOROVIC, P.
National Forests,	Emulsion Breaking Method,	A Stochastic Model of Dispersion of Sediment
W76-05621 4D	W76-05527 5G	Particles Released from A Continuous Source,
Interpreting Stability Problems for the Land	TAYLOR, F. W.	W76-05663 2J
Manager,	Evaporator-Condenser Unit for Producing	Charles Toronto Company
W76-05947 4D	Potable Water From Sewage.	TONN, R. J.
	W76-05960 5D	Breeding Places and Seasonal Incidence of
Road Standards on Steep Terrain in the Pacific		Aedes Aegypti, as Assessed by the Single- Larva Survey Method,
Northwest U.S.A. with Suggestions for Imple-	TAYLOR, G. S.	W76-06033 5G
mentation, W76-05948 4C	Coupled Saturated-Unsaturated Transient Flow	
W 70-03948 4C	in Porous Media: Experimental and Numeric	TOOTILL, S.
Slope Stability Problems Associated with	Model, W76-05684 2F	The Movement of Melting Ice over Rough Sur-
Timber Harvesting in Mountainous Regions of	W 70-03064 2F	faces,
the Western United States,	TEESDALE, C.	W76-05671 2C
W76-05944 4C	Breeding Places and Seasonal Incidence of	TOPPING, M. S.
SWEENEY, R. J.	Aedes Aegypti, as Assessed by the Single-	Effect of Environmental Factors on Standing
The Economics of Alternative Deep Seabed	Larva Survey Method,	Crop of Plankton in British Columbia Lakes,
Regimes,	W76-06033 5G	W76-05741 5C
W76-05816 6E		
	TEJIMA, S.	TORNABENE, M. G.
SWERED, P.	Removal of Ammonia Nitrogen by Catalytic	Wave-Action Power Apparatus,
Synergistic Compositions Containing 2,2-	Oxidation Filter Bed (Sesshoku sanka rosho ni	W76-05549 8C
Dibromo-3-Nitrilopropionamide and 3,3,4,4-	yoru ammonia-set chisso no jokyo),	TORPEY, W. N.
Tetrachlorotetrahydro-Thiopene-1,1-Dioxide	W76-05589 5D	Method for the Primary and Secondary Treat-
and Their Use, W76-05531 5F	TEMPLER, O. W.	ment of Wastewater in a Unitary Apparatus,
# /0-05551 SF	Institutional Constraints and Conjunctive	W76-05972 5D
SWOPE, H. G.	Management of Water Resources in West	
Municipal Plant Handles 44% Pulp and Paper	Texas,	Wastewater Treatment,
Mill Wastes,	W76-05842 6E	W76-05579 5D
W76-05778 5D		TRACHSEL, A.
SYED, N. C.	TERHAAR, C. J.	Technical-Economic Product Design as
Inter Basin Transfer of Water Resource Case	Silver in Photoprocessing Effluents,	Typified by a Sewage Pumping Installation,
Study of Indus Project,	W76-05732 5D	W76-05591 5D
W76-05753 4A	THOMMES, M. M.	
	Body Temperature Change Characteristics of	TRAKHTENBERG, B. K.
SZALAY, M.	Lake Michigan Fishes,	Hydraulic Computation of a Pool Hollow,
Nomograms for Simplified Hydraulic Dimen-	W76-05899 5C	W76-05931 2E
sioning of Waste Water Ducts (Nomogramme Zur Vereinfachten Hydraulischen Bemessung		TRAIL I
Von Abwasser-Kanaelen),	Body Temperatures of Fish Feeding in The	TRAU, J. Analysis of Pulp and Paper Mill Waste Waters
W76-05610 5D	Point Beach Thermal Discharge,	by High-Resolution Ion-Exchange Chromatog-
	W76-05900 5C	raphy,
TAFELSKI, R. D.		W76-05709 5A
Colorado City Solves its Sand Pumping	Comparison of the Movement and Recapture of	
Problems,	Salmonid Fishes Tagged at Two Power Plants, W76-05894 5C	TRIPATHI, R. P.
W76-055_9 8C	W76-05894 5C	Evaporation Characteristics of Three Fine-Tex-
TAGLIAFERRI, G.	Origin of Fin-Clipped Salmonids Collected at	tured Tarai Soils Under Various Evaporation
Multistage Flash Evaporator for Producing Soft	Two Thermal Discharges on Lake Michigan,	Potentials, W76-06037 2D
Water from a Saline Water,	W76-05895 5C	W76-06037 2D
W76-05978 3A		TRPIS, M.
TAHA M W	THOMPSON, J. C.	Breeding Places and Seasonal Incidence of
TAHA, M. W. Ionic Leaf Accumulation in Grapes, Guava and	Old Slow Sand + New Rapid Filtration - Sedi-	Aedes Aegypti, as Assessed by the Single-
Olive Plants as Affected by the Salinity of Ir-	mentation = Savings,	Larva Survey Method,
rigation Water,	W76-05808 5F	W76-06033 5G
W76-06030 3C	THOMPSON, R. G.	TRUBACHEV I N
	An Economic Model of Water Use and Waste	TRUBACHEV, I. N. Productivity and Biochemical Composition of
TAKATA, Y.	Treatment,	Chlorella at Different Levels of Illumination
Method of Preventing Scale From Being	W76-05814 5D	and Nitrogen Limitation,
Deposited In Case of Producing Fresh Water From Sea Water,		W76-05640 5C
W76-05971 3A	THOMSOM, S. V.	
	Occurrence of Phytophthora Species and Other	TRUETT, J. B.
TAKEUCHI, K.	Potential Plant Pathogens in Recycled Irrigation	Impacts of Hydrologic Modification on Water
Flowmeter for an Open Aqueduct,	Water,	Quality, W76-05866 5G
W76-05540 7B	W76-06010 5C	11 10-03000

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WENI Pro-Cell W7

WHIT Geo Aqu W7

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TSCHANTZ, A.

TSCHANTZ, A. Impact of Coal Strip Mining on Water Quality and Hydrology of East Tennessee,	Evaluation of Surface Water Pollution at Several Points in Relation to Zones of Shellfish Industry in Roadsteads of the Brest Region, (In	Sedimentary Pu-239, Pu-240 Phase Distribu- tions in Lake Michigan Sediments, W76-05891 5B
W76-05833 5B	French), W76-06150 5B	WAID, J. S.
TSUJI, T. Method of Extracting Heavy Metals from Industrial Waste Waters,	VELA SALGADO, E. H. Principal Economic Aspects of the Problem of	Microorganisms and Sulphide in a Polluted Estuary, W76-06121 5C
W76-05966 5D	Salinity of the Colorado River, W76-05821 6E	WALFORD, M. E. R.
TURK, L. J. Aquifer Evaluation Using Depositional	VENKATESWARA RAO, V.	The Movement of Melting Ice over Rough Surfaces,
Systems: An Example in North-Central Texas, W76-05554 2F	Effect of Different Methods of Planting in Pud- dled Soil on the Yield of Rice, W76-06017 3F	W76-05671 2C WALKER, K. F.
TURKINGTON, C. R.	W/6-0001/	Seasonal Dynamics and Productivity of Tany-
Grapevine Response to Furrow and Trickle Irrigation,	VIJAYARAGHAVAN, S. Seasonal Variation in Dissolved Carbohydrate (DCHO) Content in Three Freshwater Ponds,	tarsus Barbitarsis Freeman (Diptera:Chironomidae) in the Benthos of a
W76-06032 3F	W76-06117 2H	Shallow, Saline Lake, W76-06142 5C
TURNER, J. K.	VIRKOLA, NE.	WALLE I B
Filtering Apparatus and Process, W76-05546 5D	Position of a Calcium Bisulfite Pulp Mill Par- ticularly with Respect to Intensified Environ-	WALLIS, J. R. Comment Upon Multivariate Synthetic Hydrology,
TUTSCHEK, E.	mental Protection Requirements (Die Position einer Kalziumbisulfitfabrik, besonders im Hin-	W76-05909 2A
Experiences and Possibilities with the Andritz- Sem Double Wire Press for Sludge Dewatering,	blick auf verschaerfte Umweltschutzforderun-	WALLS, J. S.
Particularly in the Paper, Pulp and Board In-	gen), W76-05722 5G	Protecting Groundwater from Landfill Leachate.
dustry (Erfahrungen und Moeglichkeiten mit der Andritz-Sem Doppelsiebpresse bei der	VIRMANI, S. M.	W76-05599 5G
Schlamment-waesserung, insbesondere in der Papier-, Zellstoff-und Karto	Climatic Water Balance at Hissar, W76-06041 2B	WALTER, C. R. Brooklyn Plant Meets Major Challenges,
W76-05729 5E	VISMAN, J.	W76-05768 5D
TYO, R. M.	Method and Apparatus for Centrifugally	WALTERS, L. J. JR.
Comparative Toxicity of Polyelectrolytes to Selected Aquatic Animals, W76-05740 5C	Separating Finely Divided Solids from Aqueous Suspensions Thereof, W76-05543 5D	Mercury Occurrence in Sediment Cores from Western Lake Erie, W76-06137 5B
		W/6-0613/
URSIC, S. J. Harvesting Southern Forests: A Threat to	VISWANATHAN, C. V. Factors in the Purification of Flowing Sewage and Activated Sludge Process, Part I,	WANG, W-C. Chemistry of Mud-Water Interface in an Impoundment,
Water Quality, W76-05945 5B	W76-05795 5D	W76-05630 5C
Pine Management Influences the Southern Water Resource,	VODOGRETSKIY, V. YE. Slope Runoff and Its Change Under the Effect	WAPNER, M. Second Annotated Bibliography on Biological
W76-05616 5B	of Agricultural and Forest Improvement Prac- tices,	Effects of Metals in Aquatic Environments, W76-05863
VAN EVERDINGEN, R. O.	W76-05927 4C	
Subsurface Disposal of Liquid Industrial	VOLKOVA, E. K.	WAREN, F. A. O. Apparatus for the Collection of Buoyant
Wastes, W76-05573 5B	Productivity and Biochemical Composition of Chlorella at Different Levels of Illumination	Foreign Matter, W76-05534 5G
VAN MARSE, M. J.	and Nitrogen Limitation, W76-05640 5C	WASHINGTON, B.
Further Observations on the Migration of Gam- marus Zaddachisexton (Crustacea, Amphipoda)	VOLLSTEDT, T. J.	Biological Nitrification of Sludge Supernatant
in a French Stream,	Filter Cleaning Method,	by Rotating Disks, W76-05800 5D
W76-06046 2I	W76-05974 5F	
VANDEN BERG, A. Determining Aquifer Coefficients from Residual Drawdown Data.	VONHOF, J. A. Subsurface Disposal of Liquid Industrial Wastes.	WATT, W. E. QUURM - A Realistic Urban Runoff Model, W76-05577 2A
W76-05689 2F	W76-05573 5B	WAYMAN, C. W.
VANDERBORGHT, J-P.	VONIC, M.	Plutonium Concentrations in Water and
Vertical Distribution of Nitrate Concentration in Interstitial Water of Marine Sediments with Nitrification and Denitrification.	This Plant Can Use 5 Sludge Processes, W76-05798 5D	Suspended Sediment from the Miami River Watershed, Ohio, W76-05887 5B
W76-05678 5B	VONNEGUT, B. Detachment of Pendant Water Drops by High	Plutonium in Aquatic Biota of the Great Miami
VARANI, F. T.	Voltage Pulses,	River Watershed, Ohio,
Method and Apparatus for the Anaerobic	W76-05917 2B	W76-05888 5C
Digestion of Decomposable Organic Materials, W76-05981 5D	WAHLGREN, M. A. The Chemical Speciation of PU-239, PU-240 and CS-137 in Lake Michigan Waters,	WEBB, W. L. Pesticide Residue Dynamics in a Forest Ecosystem: A Compartment Model,
VEIGA-PIRES, H. Application of Factorial Analysis of Principal	W76-05889 5B	W76-05946 5B
Components to the Control of Pollution of Sur-	Effect of Municipal Treatment Processes on	WEBER, C. L.
face Waters, W76-05632 5B	PU-239, PU-240, and CS-137, W76-05890 5F	New System Puts the Wood to Wastewater, W76-05586 5D

5B ted 5C ur-2C

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C

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3

t

W76-05989

WILSON, R. T.

W76-05857 WILSON, W.

W76-06119

Table of Data on Water Quality of Baker Lake

Studies on the Ca, Mg, and Sr Content of

near Mount Baker, Washington,

Freshwater Clamshells,

5F

2H

WEISS, C. M.	WOHLFARTER, A.	ZAGHLOUL, N. A.
The Effect of Thermal Discharge on the Rate	Experiences and Possibilities with the Andritz-	A Stable Numerical Model for Local Scour,
of Accumulation of Organic Substances on	Sem Double Wire Press for Sludge Dewatering,	W76-05666 2J
Glass Surfaces Immersed in Lake Norman,	Particularly in the Paper, Pulp and Board In-	
W76-05875 5C	dustry (Erfahrungen und Moeglichkeiten mit	ZARNETT, G. D.
	der Andritz-Sem Doppelsiebpresse bei der	Energy Requirements for Conventional and
WELLBURN, A. R.	Schlamment-waesserung, insbesondere in der	Advanced Wastewater Treatment,
Detection and Preliminary Identification of En-	Papier-, Zellstoff-und Karto	W76-05702 5D
dogenous Antitranspirants in Water-Stressed	W76-05729 5E	
Sorghum Plants,	W 70-03729	ZATTERA, A.
W76-06026 21	WOLFF, P. C.	The Application of Sequential Estimation
11 70-00020	Social Assessment Manual: A Guide to the	Methods to Counts of Phytoplankton,
WENDELL, M.	Preparation of the Social Well Being Account,	W76-05622 5A
A Study of Prospective Water Pollution Con-		
trol Activities for the Ohio River Valley Water	W76-05993 6B	ZAWADZKI, I. I.
Sanitation Commission (Orsanco),	WOODARD, F. E.	On Radar-Raingage Comparison,
W76-05654 5G	Electrolytic Coagulation of Lignin from Kraft	W76-05694 2B
W 76-03034 3G		
WENDT, T. M.	Mill Bleach Plant Wastewaters,	Statistics of Raingage Data,
Process for Treating Waste Water Containing	W76-05708 5D	W76-05693 2B
	SVII I	
Cellulose Nitrate Particles,	WU, J.	ZAYTSEVA, E. A.
W76-05575 5D	Wind Effects on Stream Flows,	Slope Runoff and Its Change Under the Effect
WHITEIEID M C ID	W76-05921 2E	of Agricultural and Forest Improvement Prac-
WHITFIELD, M. S. JR.	*******	tices.
Geohydrology of the Evangeline and Jasper	YAHIA, T. A.	W76-05927 4C
Aquifers of Southwestern Louisiana,	Effect of Surface Applied Sulfuric Acid on	W /0-0392/
W76-05861 2F	Water Penetration into Dry Calcareous and	ZENZ, D. R.
	Sodic Soils,	
WIKTOROWSKI, S.	W76-05907 5G	Biological Nitrification of Sludge Supernatant
Use of Ion Exchangers and Synthetic Sorbents		by Rotating Disks,
for Removal of Color from Kraft Process ef-	YAMADA, K.	W76-05800 5D
fluents (Proby zastosowania jonitow i sor-	Optimal Design Model for Waste Water Collec-	
bentow syntetycznych do usuwania barwy ze	tion System (II) (Gesuidokan kiyo keikaiu no	ZHELEZNYAK, I. A.
sciekow posiarczanosych),	saitekika moderu to sono oyo (II)),	Allowance for Precipitation and Runoff Fluc-
W76-05698 5D	W76-05598 5D	tuation Patterns in Computing Water
W 70-03098	W 70-03398	Withdrawal for Irrigation Systems in the
WILCOX, J. C.	YEFIMOVA, L. V.	Southern Ukraine,
Ratio Between Evapotranspiration from		W76-05675 4A
	Slope Runoff and Its Change Under the Effect	
Lysimeters and Evaporation from Small	of Agricultural and Forest Improvement Prac-	ZIVERT, A. A.
Evaporimeters Using 2- and 3- hour Periods of	tices,	Flood Routing in Channel Systems with Al-
Measurement,	W76-05927 4C	lowance for Bank Regulation,
W76-06029 2D		W76-05668 4A
	YOCUM, C. H.	W 70-03008
WILLEY, R. E.	Multi-Tank Ion Exchange Water Treatment	ZNAMENSKIY, V. A.
Evaluation of Data Availability and Examples	System,	Comparative Estimate of Energy Losses in
of Modeling for Ground-Water Management on	W76-05975 5F	
Cape Cod, Massachusetts,		Bodies of Water, and Quiet and Turbulent
W76-05856 4B	YORK, D. W.	Flows,
11 70 03030	Multi-Objective Water Resources Planning:	W76-05924 8B
WILLIAMS, T. C.	Methodology to Achieve Compatibility	
Plastic Pipe, Pressure Sewers, Mark Expan-	Between Environmental Amenities and	ZOETEMAN, J.
sion,	Economic Development,	Cause and Identification of Taste and Odour
W76-05765 5D	W76-05840 6B	Compounds in Water,
W 70-03703	W 70-03840	W76-06009 5A
Pond and Irrigation Systems Offer Economy	YOUNG, G. K.	
and Flexibility,	Decision Perspectives on Urban Storm Water	ZUMBRUNN, J. P.
		Process for Conditioning Effluent Con-
W76-05774 5D	Pollution,	taminated by Aldehyde Compounds,
WILLIAMS W D	W76-05509 5D	W76-05545 5D
WILLIAMS, W. D.	VOUNG W	
Distribution of Fish in Inland Saline Waters in	YOUNG, W.	ZYKOV, N. A.
Victoria, Australia,	The Influence of Dissolved Oxygen Concentra-	Design and Results of Comparative Tests of a
W76-06143 2H	tions on Three Species on Water Mites	Rainfall Recorder Operating for a Week
	(Hydracarina),	(WRR).
WILLIS, R.	W76-06133 5C	
Optimal Groundwater Quality Management:		W76-05674 7B
Well Injection of Waste Waters,	YOUSIF, F.	· ·
W76-05507 5B	On some Problems of the Biological Control of	
	Human Schistosomes in Egypt,	
WILSON, G. E.	W76-06034 5C	
Flocculation Apparatus,		
The state of the s		

Some Helminths of Bulinus Truncatus and Biomphala:ia Alexandrina from the Irrigation

ZACKRISSON, M.
Water Pollution in Connection with Bark
Dumping (Vattenfororeningar i samband med

5A

5B

System Near Cairo,

barkdeponering), W76-05726

W76-06028

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ORGANIZATIONAL INDEX

ABT ASSOCIATES, INC., CAMBRIDGE, MASS. Social Assessment Manual: A Guide to the	ALASKA UNIV., COLLEGE. INST. OF WATER RESOURCES.	Plutonium Concentrations in Water and Suspended Sediment from the Miami River
Preparation of the Social Well Being Account, W76-05993 6B	Evaluation of the Trophic Types of Several Alaskan Lakes by Assessment of the Benthic	Watershed, Ohio, W76-05887 5B
AEROJET-GENERAL CORP., EL MONTE,	Fauna, W76-05604 5C	Plutonium in Aquatic Biota of the Great Miami
CALIF. (ASSIGNEE).	W76-05604 5C	River Watershed, Ohio,
Buffered, Weak Ion-Exchange Water	ALBERTSON, SHARP AND BACKUS,	W76-05888 5C
Demineralization Process, W76-05526 3A	NORWALK, CONN. Minimal Cost Plant Cleaning Up Harbor, W76-05796 5D	The Chemical Speciation of PU-239, PU-240 and CS-137 in Lake Michigan Waters.
CONCULTUDAL PROPERTY OF STREET	W76-05796 5D	W76-05889 5B
AGRICULTURAL RESEARCH CENTER, FORT LAUDERDALE, FLA.	ALEXANDRIA UNIV. (EGYPT). FACULTY OF	
Phosphorus Removal from Static Sewage Ef-	AGRICULTURE.	Effect of Municipal Treatment Processes on
fluent Using Duckweed,	Ionic Leaf Accumulation in Grapes, Guava and Olive Plants as Affected by the Salinity of Ir-	PU-239, PU-240, and CS-137, W76-05890 5F
W76-05775 5D	rigation Water,	W /6-03890 SF
CONCRETE AT DECEARCH CERTIFICE	W76-06030 3C	Sedimentary Pu-239, Pu-240 Phase Distribu-
AGRICULTURAL RESEARCH SERVICE, ATHENS, GA. SOUTHEAST WATERSHED	ATTAMANAN INWI (MINIA) NERE OF	tions in Lake Michigan Sediments,
RESEARCH CENTER.	ALLAHABAD UNIV. (INDIA), DEPT. OF CHEMISTRY.	W76-05891 5B
Continuous Seasonal Probability of Extreme	Application of Infrared Spectroscopy to Erodi-	The Distribution of Plutonium in Lake
Rainfall Events,	bility Studies of the Soil,	Michigan Sediments,
W76-05692 2B	W76-06140 2J	W76-05892 5B
AGRICULTURAL RESEARCH SERVICE,	ALLEY (E. ROBERTS) AND ASSOCIATES,	Developments in Underwater Radiotelemetry
BELTSVILLE, MD.	BRENTWOOD, TENN.	and Preliminary Fish Tracking in Thermal
Reclamation of Soils Contaminated with	Plant Protects A Recreational Lake,	Plumes,
Radioactive Strontium,	W76-05770 5D	W76-05893 5C
W76-05906 5G	AMAX RESOURCE RECOVERY SYSTEMS,	Comparison of the Movement and Recapture of
ACDICIII TUDAL BECEABOU CERVICE	INC., DAYTON, OHIO. (ASSIGNEE).	Salmonid Fishes Tagged at Two Power Plants,
AGRICULTURAL RESEARCH SERVICE, OXFORD, MISS.	Process for the Treatment of Mineral Slimes,	W76-05894 5C
Fallout CS-137: A Tool in Conservation	W76-05973 5D	
Research,	AMERICAN CYANAMID CO., STAMFORD,	Origin of Fin-Clipped Salmonids Collected at
W76-05690 2J	CONN. (ASSIGNEE).	Two Thermal Discharges on Lake Michigan, W76-05895 5C
AGRICULTURAL RESEARCH SERVICE,	Leaching Polyelectrolyte Fluidized Solids,	
STILLWATER, OKLA, WATER	W76-05536 5D	Effects of Season, Location, and Discharge
CONSERVATION STRUCTURES LAB.	AMERICAN UNIV., WASHINGTON, D.C.	Type on Fish Distribution and Density in Ther-
Dependable Yield of Reservoirs with Intermit-	Social Science Data Banks and the Institute for	mal Plumes, W76-05896 5C
tent Inflows,	Water Resources,	
W76-05908 4A	W76-05822 6B	Characteristics of Temperature-Sensitive Fish
Discharge Equations for HS, H, and HL	AMOS TUCK SCHOOL OF BUSINESS	Tags Used in 1974,
Flumes,	ADMINISTRATION, HANOVER, N. H.	W76-05897 5C
W76-05918 8B	The Economics of Alternative Deep Seabed	Discharge Residence of TLD Tagged Fish,
	Regimes,	W76-05898 5C
AIR LIGUIDEL SOCIETE ANONYME POUR	W76-05816 6E	Body Temperature Change Characteristics of
1'ETUDE ET 1'EXPLOITATION DES PROCEDES, PARIS (FRANCE). (ASSIGNEE).	AMSTERDAM UNIV. (NETHERLANDS). INST.	Lake Michigan Fishes,
Process for Conditioning Effluent Con-	OF TAXONOMIC ZOOLOGY.	W76-05899 5C
taminated by Aldehyde Compounds,	Further Observations on the Migration of Gam- marus Zaddachisexton (Crustacea, Amphipoda)	
W76-05545 5D	in a French Stream,	Body Temperatures of Fish Feeding in The
AIRCO, INC., MONTVALE, N. J. (ASSIGNEE).	W76-06046 2I	Point Beach Thermal Discharge, W76-05900 5C
Methods and Apparatus for Treating Waste-	A DOONNE NATIONAL LAB A DOONNE ILL	
water.	ARGONNE NATIONAL LAB., ARGONNE, ILL. RADIOLOGICAL AND ENVIRONMENTAL	ARGONNE NATIONAL LAB., ILL.
W76-05987 5D	RESEARCH DIV.	RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIV.
AVADDAMY NAME OF THE OFF	Vertical Transport of Particulate Material in	Radiological and Environmental Research Divi-
AKADEMIYA NAUK SSSR, MOSCOW.	Lake Michigan by the Lorica of Codonella	sion Annual Report - Ecology, January-
INSTITUT GREGRAFII. Maps of the Elements of the Hydrologic	Cratera, W76-05881 5C	December 1974.
Budget of Asia,	W76-05881 5C	W76-05879 5C
W76-05934 2A	Distribution of Diatom Frustules in Lake	Growth of Plume Resident Fishes in Lake
	Michigan Sediment Cores,	Michigan,
AKADEMIYA NAUK SSSR, NOVOSIBIRSK.	W76-05882 5C	W76-05901 5C
INSTITUT FIZIKI. Productivity and Biochemical Composition of	Distribution of Amorphous, Diatom Frustule,	Effect of Disco Besides on the Assessed
Chlorella at Different Levels of Illumination	and Dissolved Silica in a Lead-210 Dated Core	Effect of Plume Residence on the Accumula- tion of Cs137 by Lake Michigan Salmonids,
and Nitrogen Limitation,	from Southern Lake Michigan, W76-05883 5C	W76-05902 5C
W76-05640 5C	W76-05883 5C	
ALASKA UNIV COLLEGE CEODUVEICA	Stable Lead Geochronology of Fine-Grained	ARGONNE NATIONAL LAB., ILL.
ALASKA UNIV., COLLEGE. GEOPHYSICAL INST.	Sediments in Southern Lake Michigan,	RADIOOLOGICAL AND ENVIRONMENTAL RESEARCH DIV.
Nucleation Characteristics of Stream Water	W76-05884 5B	Role of Copepod Fecal Pellets in the Vertical
and Frazil Ice Nucleation,	Miami River Watershed Project: Introduction,	Transport of Freshwater Diatoms,
W76-05695 2C	W76-05886 5B	W76-05880 5C

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ARIZONA UNIV., TUCSON.

ARIZONA UNIV., TUCSON. Ex-Post Evaluation of River Basin Developments in Pakistan, W76-05748 6A	ATOMIC ENERGY COMMISSION, WASHINGTON, D. C. Comparative Risk-Cost-Benefit Study of Alter- native Sources of Electrical Energy,	BATTELLE-PACIFIC NORTHWEST LABS., RICHLAND, WASH. A Technique for Environmental Decision Mak- ing Using Quantified Social and Aesthetic
ARIZONA UNIV., TUCSON. DEPT. OF	W76-05829 6B	Values, W76-05825 5G
AGRICULTURAL ECONOMICS.	AUBURN UNIV., ALA. DEPT. OF CHEMISTRY.	
Economic Magnitudes and Economic Alterna- tives in Lower Basin use of Colorado River Water,	Nature and Stability of Complex Mercury Compounds in Surface and Ground Waters, Phase II,	BEDFORD INST., DARTMOUTH (NOVA SCOTIA). ATLANTIC OCEANOGRAPHIC LAB. Trace Metals in the Waters of the Gulf of St.
W76-05811 3A	W76-05838 5A	Lawrence, W76-06024 5A
ARIZONA UNIV., TUCSON. DEPT. OF	AUCKLAND UNIV. (NEW ZEALAND). DEPT.	
SYSTEMS AND INDUSTRIAL ENGINEERING;	OF BOTANY. Eurasian Water-Milfoil in Michigan.	BETZ LABS., INC., TREVOSE, PA.
AND ARIZONA UNIV., TUCSON. DEPT. OF HYDROLOGY AND WATER RESOURCES. Decision Making and Planning for River Basin	W76-06149 5G	(ASSIGNEE). Synergistic Compositions Containing 2,2- Dibromo-3-Nitrilopropionamide and 3,3,4,4-
Development,	AUSTRALIAN ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT,	Tetrachlorotetrahydro-Thiopene-1,1-Dioxide
W76-05752 6A	LUCAS HEIGHTS.	and Their Use, W76-05531 5F
ARIZONA UNIV., TUCSON, INST. OF	An Evaluation of the Use of Gamma Radiation	
RENEWABLE NATURAL RESOURCES. Environmental Considerations in River Basin	in Sewage Treatment, W76-05803 5D	BIO-GAS OF COLORADO, INC., DENVER. (ASSIGNEE).
Planning and Decision Making,	AUCTRALIAN MUCEUM CURNEY BERT OF	Method and Apparatus for the Anaerobic
W76-05510 4A	AUSTRALIAN MUSEUM, SYDNEY. DEPT. OF MARINE INVERTEBRATES.	Digestion of Decomposable Organic Materials,
ARIZONA UNIV., TUSCON. DEPT. OF SOILS,	The Fauna of Careel Bay with Comments on	W76-05981 5D
WATER AND ENGINEERING.	the Ecology of Mangrove and Sea-Grass Com- munities,	BIRMINGHAM UNIV. (ENGLAND). DEPT. OF
Effect of Surface Applied Sulfuric Acid on Water Penetration into Dry Calcareous and	W76-06022 2L	CIVIL ENGINEERING. Pumping-Test Analysis Using a Discrete Time-
Sodic Soils,	AUTOTROL CORP., MILWAUKEE, WIS.	Discrete Space Numerical Method,
W76-05907 5G	(ASSIGNEE).	W76-05913 4B
ARMY ENGINEER DISTRICT, CHICAGO, ILL.	Wastewater Treatment,	BIRMINGHAM UNIV. (ENGLAND). DEPT. OF
Flood Plain Information: Illinois and Michigan	W76-05579 5D	PHYSICS. Internal Reflections in Polar Ice Sheets,
Canal, Rock Run Creek, Thorne Creek, Joliet, Illinois.	Method for the Primary and Secondary Treat-	W76-05681 2C
W76-05645 4A	ment of Wastewater in a Unitary Apparatus, W76-05972 5D	BORDEAUX UNIV. (FRANCE).
ARMY ENGINEER DISTRICT,		Experimental Study of the Purification of Ef-
JACKSONVILLE, FLA. Special Flood Hazard Information Report: Howell Creek Basin Lakes, Orange County,	B. C. RESEARCH, LTD., VANCOUVER. Sensitivity of Blood Cell Counts in Juvenile Coho Salmon (Oncorhynchus Kisutch) to Stres-	fluents from the Manufacture of Bleached Bisulfite Pulp by Acration Lagooning (Etude experimentale de l'epuration par lagunage acre
Florida,	sors Including Sublethal Concentrations of Pulp Mill Effluent and Zinc,	de liqueurs bisulfitiques de pate de cellulose
W76-05646 4A	W76-05696 5C	blanchie), W76-05718 5D
Flood Plain Information: Coastal Areas, Levy	Effect of Bleached Kraft Mill Effluent on the	
County, Florida. W76-05647 4A	Survival of Starved Juvenile Coho Salmon	BOVAY ENGINEERS, INC., SPOKANE, WASH. Industrial Cost Recovery and User Charge As-
	(Oncorhynchus Kisutch), W76-05710 5C	sessments,
ARMY ENGINEER DISTRICT, SACRAMENTO, CALIF.		W76-05813 5G
Plan Formulation and Evaluation Studies	BADGER (W. L.) ASSOCIATES, INC., ANN ARBOR, MICH.	BOVET (ERIC D.) ALEXANDRIA, VA.
Recreation. Vol. II of V. Estimating Initial	Operation of Pilot Plant LTV Evaporator at	Evaluation of Quality Parameters in Water
Reservoir Recreation Use, W76-05611 6B	Wrightsville Beach, North Carolina. W76-06049 3A	Resource Planning: A State-of-the-Art Survey of the Economics of Water Quality,
ARMY ENGINEER DISTRICT, SAVANNAH,	***	W76-05818 5G
GA.	BALL STATE UNIV., MUNCIE, IND. Macrobenthic Population Dynamics in Indiana	BOWLING GREEN STATE UNIV., BOWLING
Flood Plain Information: Little McMullen	Waters of Lake Michigan in 1970,	GREEN, OHIO. DEPT. OF GEOLOGY.
Creek, Jesup, Georgia. W76-05648 4A	W76-05623 5C	Mercury Occurrence in Sediment Cores from Western Lake Erie.
	BANGALORE UNIV. (INDIA). DEPT. OF	W76-06137 5B
ASBURY COLL., WILMORE, KY. Some of the Effects of Domestic Sewage	ZOOLOGY. Effect of Running Water on the Predatory Effi-	BOYLE ENGINEERING, VENTURA, CALIF.
Discharge into Hickman and Jessamine Creeks	ciency of the Larvivorous Fish Cambusia Af-	Regional Plant Treats Septic Wastes,
in Jessamine County, Kentucky, W76-05841 5B	finis, W76-06021 21	W76-05771 5D
		BRISTOL UNIV. (ENGLAND). H. H. WILLS
ASHI KASEI KOGYO KABUSHIKI KAISHA, OSAKA (JAPAN). (ASSIGNEE).	BANGKOK METROPOLITAN WATER WORKS AUTHORITY (THAILAND).	PHYSICS LAB. The Movement of Melting Ice over Rough Sur-
Desalination Process by Improved Multistage	Views on River Basin Development in Thai-	faces,
Electrodialysis, W76-05980 3A	land,	W76-05671 2C
	W76-05520 4A	BRITISH COLUMBIA UNIV., VANCOUVER.
ATLANTIC FLUIDICS, INC., STAMFORD, CONN. (ASSIGNEE).	BARI UNIV. (ITALY). Detailed Economic Models for Industrial and	DEPT. OF GEOPHYSICS.
Sewage Treatment System,	Other Activities,	The Thermal Regime of Trapridge Glacier and Its Relevance to Glacier Surging,
W76-05969 5D	W76-05817 5G	W76-05916 2C

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BRITISH COLUMBIA UNIV., VANCOUVER.	CALIFORNIA UNIV., BERKELEY. DEPT. OF	CENTRAL INLAND FISHERIES RESEARCH
WESTWATER RESEARCH CENTRE. International River Basin Cooperation: Some	PLANT PATHOLOGY. Occurrence of Phytophthora Species and Other	INST., CUTTACK (INDIA). FISHERIES RESEARCH STATION.
Factors Influencing Agreement,	Potential Plant Pathogens in Recycled Irrigation	Observations on the Seasonal Fluctuations of
W76-05758 6E	Water,	Plankton in the Chilka Lake,
	W76-06010 5C	W76-06118 2H
BROWN AND CALDWELL, WALNUT CREEK,	CALIFORNIA UNIV., BERKELEY,	CENTRAL MARINE FISHERIES RESEARCH
CALIF. Lime Recovery and Reuse in Primary Treat-	SEISMOLOGICAL LAB.	INST., COCHIN (INDIA).
ment.	Seismic Instrumentation of Dams,	Seasonal Variation in Dissolved Carbohydrate
W76-05785 5D	W76-05667 8D	(DCHO) Content in Three Freshwater Ponds, W76-06117 2H
Lime Use in Wastewater Treatment: Design	CALIFORNIA UNIV., DAVIS. DEPT. OF	CENTRAL SOIL SALINITY RESEARCH INST.,
and Cost Data, W76-05868 5D	WATER SCIENCE AND ENGINEERING. Coupled Saturated-Unsaturated Transient Flow	KARNAL (INDIA). Effect of Depth and Salinity of Ground Water
BROWN UNIV., PROVIDENCE, R. I.	in Porous Media: Experimental and Numeric	on Evaporation and Soil Salinization,
Social Impact Assessment: An Analytic	Model, W76-05684 2F	W76-06036 2D
Bibliography,		Studies on Depth and Quality of Water on Soil
W76-05820 6B	CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL SCIENCE AND AGRICULTURAL	Salinization: Behaviour of Anions in the Soil Profile with Reference to the Position of Water
BRUSSELS UNIV. (BELGIUM). INDUSTRIAL	ENGINEERING.	Table,
CHEMISTRY INST.	Solute Travel-Time Estimates for Tile-Drained	W76-06141 2G
Vertical Distribution of Nitrate Concentration in Interstitial Water of Marine Sediments with	Fields: I. Theory, W76-05904 5B	CENTRAL WASHINGTON STATE COLL.,
Nitrification and Denitrification,	W 70-03904 3B	ELLENSBURG.
W76-05678 5B	Solute Travel-Time Estimate for Tile-Drained	The Columbia Basin Project Reappraised,
	Fields: II. Application to Experimental Studies,	W76-05750 4A
BUREAU OF RECLAMATION, MILES CITY, MONT. DIV. OF ATMOSPHERIC WATER	W76-05905 5B	CENTRALNE LABORATORIUM
RESOURCES MANAGEMENT.	CAMP DRESSER AND MCKEE, INC., BOSTON,	DZIEWIARSTWA (POLAND).
Field Observations of the Persistence of AgI-	MASS.	Processing of Sediments from Coagulation Ap-
NH4I-Acetone Ice Nuclei in Daylight,	Old Slow Sand + New Rapid Filtration - Sedi-	plied as the Third Stage of Effluent Purification
W76-05677 3B	mentation = Savings,	(Przerabianie osadow powstajacych przy
BUDNE AND MCDONNELL PANCACCITY	W76-05808 5F	zastosowaniu koagulacji jako trzeciego stopnia oczyszczania sciekow z przemyslu włokiennic-
BURNS AND MCDONNELL, KANSAS CITY, MD.	CANADA CENTRE FOR INLAND WATERS,	zego),
Aerated Lagoons Solve Town's Site Problems,	BURLINGTON (ONTARIO).	W76-05697 5D
W76-05799 5D	Automated Dilution for Measurement of	CONTRO DI DICEDIO I IDM DI BISA (ITALIA)
	Nitrate in Water,	CENTRO DI RICERCA IBM DI PISA (ITALY). Comment Upon Multivariate Synthetic
CAIRO UNIV., GIZA (EGYPT). DEPT. OF	W76-05594 5A	Hydrology,
BOTANY. Eco-Physiological Studies on Desert Plants: IX.	CANADIAN PATENTS AND DEVELOPMENT	W76-05909 2A
Types of Transpiration Curves of Zilla Spinosa	LTD., OTTAWA (ONTARIO). (ASSIGNEE).	CENTRO DI CREBIMENTA ZIONE
Prantl Under Natural Conditions,	Method and Apparatus for Centrifugally	CENTRO DI SPERIMENTAZIONE CARTOTECNICA, MILAN (ITALY).
W76-06123 2D	Separating Finely Divided Solids from Aqueous	Biological Treatment by a System of Activated
CALGARY UNIV. (ALBERTA). DEPT. OF	Suspensions Thereof, W76-05543 5D	Sludge Applied to the Effluent Waters of a
BIOLOGY.	W 76-03343	Corrugated Board Plant,
Response of Soil Testacea to Soil Moisture	CANTERBURY UNIV., CHRISTCHURCH (NEW	W76-05713 5D
Fluctuations,	ZEALAND). DEPT. OF BOTANY.	CESKOSLOVENSKA AKADEMIE VED,
W76-06038 2G	Microorganisms and Sulphide in a Polluted	PRAGUE. HYDROBIOLOGICKA LABORATOR.
CALGON CORP., PITTSBURGH, PA.	Estuary, W76-06121 5C	On the Possibilities of Averaging the Seasonal
(ASSIGNEE).	W 70-00121	Pattern in Kjeldahl Nitrogen in a Group of Water Bodies.
Inhibition of Scale Deposition,	CAPE COAST UNIV. (GHANA). DEPT. OF	W76-06019 5B
W76-05529 5D	PHYSICS.	COSVAGI OVENSVA AVAREMIE UPR
CALIFORNIA INCE OF TECH BACABENA	Surface Energy Budget of Some Climatic	CESKOSLOVENSKA AKADEMIE VED, PRAGUE. PARAZITOLOGICKY USTAV.
CALIFORNIA INST. OF TECH., PASADENA. DIV. OF HUMANITIES AND SOCIAL	Regimes in West Africa, W76-06006 2B	Some Helminths of Bulinus Truncatus and
SCIENCES.		Biomphalaria Alexandrina from the Irrigation
Social Impacts of Integrated River Basin	CAPE TOWN UNIV. (SOUTH AFRICA).	System Near Cairo,
Development on Local Populations,	The Ecology of Morrumbene Estuary, Mozam-	W76-06028 5A
W76-05755 6A	bique, W76-06127 2L	On some Problems of the Biological Control of
CALIFORNIA UNIV. BERKELEY; AND CLEAR	W76-06127 2L	Human Schistosomes in Egypt,
LAKE ALGAL RESEARCH UNIT, LAKEPORT,	CENTER FOR DISEASE CONTROL, ATLANTA,	W76-06034 5C
CALIF.	GA.	CHEVRON OIL CO., NEW ORLEANS, LA.
Algal Nitrogen Fixation in Californian Streams:	Outbreaks of Waterborne Disease in the United	Simple Procedures Can Help Reduce Drill Pipe
Seasonal Cycles, W76-05639 5C	States, 1971-1972, W76-06138 5C	Damage, W76-05572 8C
		W /0-033/2
CALIFORNIA UNIV., BERKELEY. DEPT. OF	CENTRAL BOARD OF IRRIGATION AND	CIBA-GEIGY CORP., GREENSBORO, N. C.
CIVIL ENGINEERING.	POWER, NEW DELHI (INDIA).	DYESTUFFS AND CHEMICALS DIV.
An Identification Approach to Subsurface Hydrological Systems.	Water Resources Development in the Ganga- Ghagra Interbasin in Uttar Pradesh (India),	Removal of Detergent Fluorescent Whitening Agents from Waste Water,
W76-05688 2F	W76-05763 4A	W76-05804 SD

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CIBA-GEIGY LTD., BASEL (SWITZERLAND). (ASSIGNEE).

CIBA-GEIGY LTD., BASEL (SWITZERLAND).	LABORATORIO RADIOATTIVITA	CROMPTON AND KNOWLES CORP.,
(ASSIGNEE).	AMBIENTALE.	WORCESTER, MASS.
Apparatus for the Treatment of Liquid Wastes, W76-05967 5D	Instrumental Method for the Determination of Trace Elements in Water Samples by Neutron	Biological Treatment of Dyes, W76-05737 5D
CLAPSADDLE-GARBER, MARSHALLTOWN,	Activation Analysis, W76-05998 5A	CROWN ZELLERBACH CORP., CAMAS,
IOWA.		WASH.
Conversion of a Trickling Filter Plant to Ac- tivated Sludge,	COMITATO NAZIONALE PER L'ENERGIE NUCLEARE, ROME (ITALY).	Status of Water Pollution Control in the Soviet Union.
W76-05588 5D	TECHNOLOGICAL LAB.	W76-05714 5G
CLAREMONT MEN'S COLL., CALIF. DEPT. OF MATHEMATICS.	The Application of Sequential Estimation Methods to Counts of Phytoplankton,	CULTURE CENTRE OF ALGAE, PROTOZOA,
Minimizing the Operating and Capital Costs of	W76-05622 5A	CAMBRIDGE (ENGLAND).
Water Supply Projects, W76-05522 6A	COMMISSARIAT A L'ENERGIE ATOMIQUE,	Survival of Escherichia Coli in Stream Water in Relation to Carbon Dioxide and Plant
	SACLAY (FRANCE). CENTRE D'ETUDES NUCLEAIRES: AND COMMISSARIAT A	Photosynthesis,
CLEMSON UNIV., S. C. DEPT. OF ENVIRONMENTAL SYSTEMS ENGINEERING.	L'ENERGIE ATOMIQUE, SACLAY (FRANCE).	W76-05628 5C
Restoring the Quality of Urban Receiving	DEPARTEMENT DE RECHERCHE ET	DACY (G. H.) ASSOCIATES, INC., MIAMI,
Waters: Interfacing Upgraded Treatment	ANALYSE.	FLA.
Facilities with the Stream,	Isotopic Study of Hail, W76-05665 2B	Reverse Osmosis Plant Helps City Cope with
W76-05839 5D	W76-05665 2B	Diminishing Groundwater Supply, W76-05779 5F
Multi-Objective Water Resources Planning:	COMMISSION OF THE EUROPEAN	770-05772
Methodology to Achieve Compatibility	COMMUNITIES, BRUSSELS (BELGIUM); AND	DAMES AND MOORE, BOCA RATON, FLA.
Between Environmental Amenities and	CENTRE D'ETUDE DE L'ENERGIE	Aquifer Evaluation Using Depositional
Economic Development,	NUCLEAIRE, MOL (BELGIUM). Contamination of Freshwater by Mn54 and	Systems: An Example in North-Central Texas, W76-05554
W76-05840 6B	Co60.	W 76-03334 2F
COLORADO STATE UNIV., FORT COLLINS.	W76-05903 5C	DEGREMONT SOCIETE GENERALE
Emory Oak (Quercus Emoryi) Litter Phenolics		D'EPURATION ET D'ASSAINISSEMENT,
as Environmental Hazards for Aquatic Animals	COMMONWEALTH SCIENTIFIC AND	RUEIL-MALMAISON (FRANCE). (ASSIGNEE).
in Southeastern Arizona, W76-06125 5B	INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA), DIV. OF	Method of Biological Purification of Sewage, W76-05524 5D
W 10-00125	ENTOMOLOGY.	W 70-03324 3D
COLORADO STATE UNIV., FORT COLLINS.	The Effects of Size-Selection Predation and	DELAWARE UNIV., NEWARK. COLL. OF
DEPT. OF AGRONOMY.	Environmental Variation on the Distribution	MARINE STUDIES; AND DELAWARE UNIV.,
Salt Transport in Soil Profiles with Application to Irrigation Return Flow, The Dissolution and	and Abundance of a Chironomid, Paraborniella	NEWARK. DEPT. OF CIVIL ENGINEERING.
Transport of Gypsum in Soils,	Tonnoiri Freeman, W76-06130 2I	Wind Effects on Stream Flows, W76-05921 2E
W76-05836 5B	W 70-00130	1170-05721
COLORADO STATE UNIV., FORT COLLINS.	COMMONWEALTH SCIENTIFIC AND	DEPARTMENT OF AGRICULTURE AND
DEPT. OF CIVIL ENGINEERING.	INDUSTRIAL RESEARCH ORGANIZATION,	FISHERIES, DUBLIN (IRELAND). ADVISORY SERVICES AND LIVESTOCK.
Precipitation Management for Reclamation of	TOWNSVILLE (AUSTRALIA). PASTORAL RESEARCH LAB.	Eutrophication of an Inland Lake in Ireland in
Overgrazed Areas in Arid and Semi-Arid Re-	The Annual Variation in Yield of Pastures in	Association with the Intensification of Pig
gions, W76-05603 2B	the Seasonally Dry Tropics of Queensland,	Farming in the Catchment Areas,
W 70-03003	W76-06016 3F	W76-05629 5C
COLORADO STATE UNIV., FORT COLLINS.	CONFERENCE BOARD, INC., NEW YORK.	DEPARTMENT OF AGRICULTURE,
DEPT. OF ECONOMICS.	The Economics of Clean Water. Volume III.	SUMMERLAND (BRITISH COLUMBIA).
An Economic Analysis of Water Use in Colorado's Economy,	Industry Expenditures for Water Pollution	RESEARCH STATION.
W76-05837 6B	Abatement.	Ratio Between Evapotranspiration from
	W76-05951 5G	Lysimeters and Evaporation from Small Evaporimeters Using 2- and 3- hour Periods of
COLORADO STATE UNIV., FORT COLLINS. HYDROLOGY AND WATER RESOURCES	COPENHAGEN UNIV., DENMARK. INST. OF	Measurement,
PROGRAM.	PHYSICAL OCEANOGRAPHY.	W76-06029 2D
Regional Water Exchange for Drought Allevia-	A Spectral Light Absorption Meter for Mea-	DEBARRATION OF THE PARTY OF THE
tion,	surements in the Sea, W76-05680 7B	DEPARTMENT OF THE ENVIRONMENT, BURLINGTO (ONTARIO).
W76-05819 4A	W 70-03080 /B	Canadian Water Resources Information: A
COLORADO UNIV., BOULDER. DEPT. OF	CORNELL UNIV., ITHACA, N. Y. SCHOOL OF	Network Approach,
CIVIL AND ENVIRONMENTAL	CIVIL AND ENVIRONMENTAL	W76-05952 10D
ENGINEERING. Lime-Induced Reactions in Municipal Waste-	ENGINEERING. Optimal Groundwater Quality Management:	DEPARTMENT OF THE ENVIRONMENT,
waters,	Well Injection of Waste Waters,	OTTAWA (ONTARIO). INLAND WATERS
W76-05597 5D	W76-05507 5B	DIRECTORATE.
	CORRE OF ENGINEERS WASHINGTON TO	Subsurface Disposal of Liquid Industrial
COLORADO UNIV., BOULDER. INST. OF ARCTIC AND ALPINE RESEARCH; AND	CORPS OF ENGINEERS, WASHINGTON, D.C. Evaluation of Economic Benefits for Flood	Wastes, W76-05573 5B
COLORADO UNIV., BOULDER, DEPT. OF	Control and Water Resource Planning.	W76-05573 5B
GEOLOGICAL SCIENCES.	W76-06083 4A	Determining Aquifer Coefficients from
Collapse of the Hudson Bay Ice Center and	COWICONSHIT LTD. CORENIL CEN	Residual Drawdown Data,
Glacio-Isostatic Rebound, W76-05669 2C	COWICONSULT LTD., COPENHAGEN (DENMARK).	W76-05689 2F
W76-05669 2C	Groundwater Study of a Volcanic Area Near	DEPARTMENT OF THE ENVIRONMENT,
COMITATO NAZIONALE PER L'ENERGIA	Bandung, Java, Indonesia,	OTTAWA (ONTARIO). INLAND WATERS
NUCLEARE, CASACCIA (ITALY).	W76-05914 4B	DIRECTORATE: AND DEPARTMENT OF THE

ORGANIZATIONAL INDEX

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E

FOREST SERVICE (USDA), CORVALLIS, OREG. PACIFIC NORTHWEST FOREST AND

ENVIRONMENT, OTTAWA (ONTARIO).	EG AND G WASHINGTON ANALYTICAL	Environmental Protection AgencyPoultry
GLACIOLOGY DIV. The Permittivity and Attenuation in	SERVICES CENTER, INC., ROCKVILLE, MD. An Assessment of Automatic Sewer Flow Sam-	Processing Products, Proposed Performance and Pretreatment Standards.
Polycrystalline and Single-Crystal Ice Ih at 30	plers - 1975,	W76-06096 5G
and 60 MHz, W76-05672 2C	W76-05864 5D	Water Quality Standards: Oregon (Withdrawal
	Sewer Flow Measurement - A State-Of-The-Art	of Proposed Rule Making).
Brittle Fracture of Ice at 77 K, W76-05673 2C	Assessment, W76-05865 5D	W76-06098 5G
		ENVIRONMENTAL RESEARCH LAB.,
DEPARTMENT OF THE ENVIRONMENT,	ELECTROLYSIS POLLUTION CONTROL INC.,	ATHENS, GA.
READING (ENGLAND).	MINNEAPOLIS, MINN. (ASSIGNEE).	Chemical Characterization of Industrial Waste-
Progress in Methods of Nitrate Removal,	Removal of Immiscible Fluids from Water Sur-	waters by Gas Chromatography-Mass Spec-
W76-05805 5D	faces and Lake Beds,	trometry,
DEPARTMENT OF THE ENVIRONMENT,	W76-05984 5G	W76-06008 5A
READING (ENGLAND). CENTRAL WATER	ENERGY RESEARCH AND DEVELOPMENT	
PLANNING UNIT.	ADMINISTRATION, AMES, IOWA; AND AMES	ENVIRONMENTAL RESEARCH LAB.,
Normal Mode Analysis of the Linear Equation	LAB., IOWA.	NARRAGANSETT, R.I.
of Groundwater Flow,	Removal of Copper and Iron Prior to Water	Second Annotated Bibliography on Biological Effects of Metals in Aquatic Environments,
W76-05685 2F	Hardness Titration,	W76-05863 5C
	W76-05716 5A	W 70-03803
DEPARTMENT OF THE INTERIOR,		ENVIRONS ENGINEERING ENTERPRISES,
WASHINGTON, D. C. OFFICE OF THE	ENVIREX, INC., MILWAUKEE, WIS.	INC., HONEYBROOK, PA. (ASSIGNEE).
SECRETARY. (ASSIGNEE).	Engineers Can Exert Process Control Over	Sewage Treatment and Recycling System,
Method for Removing Soluble Selenium from	Digester Inputs,	W76-05988 5D
Acidic Waste Water,	W76-05807 5D	
W76-05986 5D	ENVIREX, INC., WAUKESHA, WIS.	ESCHER WYSS G.M.B.H., RAVENSBURG
DEPARTMENT OF THE NAVY,	(ASSIGNEE).	(WEST GERMANY).
WASHINGTON, D.C. OFFICE OF THE	Submerged Air Release Device Particularly for	Escher-Wyss Flotation Cells for Clarification
SECRETARY.	Sewage Treatment,	and Cleaning (Die Escher-Wyss Flotationszel-
Water Level Gauge,	W76-05581 5D	len zur Klaerung und Reinigung),
W76-05977 7B	W 70 03301	W76-05723 5D
	ENVIREX, INC., WAUKESHA, WIS. WATER	
DONG KOOK UNIV., SEOUL (REPUBLICOF	QUALITY CONTROL DIV.	FACUZZI BROS., INC., LITTLE ROCK, ARK.
KOREA). DEPT. OF SCIENCE EDUCATION.	How Does Tank Geometry Affect the Oxygen	(ASSIGNEE).
Studies on the Effects of Copper on the Lac-	Transfer Rate of Mechanical Surface Aerators.	Pollution Control System for Water Supply,
tate Dehydrogenase and Esterase Isozymes in	W76-05593 5D	W76-05530 5F
Various Tissues of Carassius Carassius,		WINDOW PORTOR BOOK A BOTT INCO
W76-05595 5C	ENVIRONMENT ONE CORP., SCHENECTADY,	FINNISH FOREST RESEARCH INST.,
DODD OF WED ONDS AND MADD OF	N. Y. (ASSIGNEE).	HELSINKI.
DORR-OLIVER (INDIA) LTD., MADRAS.	Process and Equipment for Automatic Chemi-	Transfer of Lindane from Bark of Insecticide-
Tertiary Treatment Plant for Multistoried	cal-Biological Wastewater Treatment with	Sprayed Pine Pulpwood into Effluent from a
Building, W76-05789 5D	Provisions for Recycle and Reuse,	Barking Drum (Lindaanin huuhtoutumisesta
W 76-03789 3D	W76-05955 5D	suojaruiskutetun mantykuitupuun kuoresta
DRAKE UNIV., DES MOINES, IOWA. DEPT. OF	ENVIRONMENTAL HEALTH LAB.,	rumpukuorimon jateveteen), W76-05734 5B
PHYSICS.	MCCLELLAN AFB, CALIF.	W76-05734 5B
Anaerobic Digestion: The Rate-Limiting	Wastewater Treatment Evaluation, Mather Air	FOREST SERVICE (USDA), BERKELEY,
Process and the Nature of Inhibition,	Force Base, California,	CALIF., PACIFIC SOUTHWEST FOREST AND
W76-05784 5D	W76-05801 5D	RANGE EXPERIMENT STATION.
		Reservoir Sedimentation Associated with
DU PONT DE NEMOURS (E. I.) AND CO.,	Wastewater Treatment Evaluation, Mt. Hebo	Catchment Attributes, Landslide Potential,
WILMINGTON, DEL. (ASSIGNEE).	Air Force Station, Oregon,	Geologic Faults, and Soil Characteristics,
Biodegradation of Methanolic Waste Water,	W76-05802 5D	W76-05617 4D
W76-05525 5D	ENVIRONMENTAL PROTECTION ACENCY	
EAST CENTRAL FLORIDA REGIONAL	ENVIRONMENTAL PROTECTION AGENCY, GULF BREEZE, FLA. GULF BREEZE	The Hydrologic Potential of Unit Areas: A
PLANNING COUNCIL, WINTER PARK.	ENVIRONMENTAL RESEARCH LAB.	Basis for Managing Water Resources,
Perspective 75.	Mirex Residues in Selected Estuaries of South	W76-05620 4D
W76-05651 6B	Carolina: June 1972,	PARTOR AND MAD AN ACCOUNT A LANG.
1170-03031	W76-05954 5A	FOREST SERVICE (USDA), CORVALLIS,
EASTMAN KODAK CO., ROCHESTER, N. Y.	W 10 02701	OREG. PACIFIC NORTHWEST FOREST AND
Silver in Photoprocessing Effluents,	ENVIRONMENTAL PROTECTION AGENCY,	RANGE EXPERIMENT STATION.
W76-05732 5D	WASHINGTON, D.C.	Effects of Forest Fertilization on Two
	Thermal Processing and Land Disposal of Solid	Southeast Alaska Streams,
ECODYNE CORP., CHICAGO, ILL.	Waste.	W76-05612 5C
(ASSIGNEE).	W76-06082 5D	Comparative Effectiveness of the Standard
Water Treating Apparatus,	Delivery of Description (Description	Surber Sampler and a Hydraulic Modification
W76-05547 5F	Designation and Determination of Removability of Hazardous Substances from Water.	for Estimating Bottom Fauna Populations,
ECONOMIC COMMISSION FOR ASIA AND	of Hazardous Substances from Water. W76-06084 5G	W76-05613 7B
THE PACIFIC, BANGKOK (THAILAND).	W /0-00084	
Multipurpose River Project Planning in the	Timber Products Processing Point Source	Estimating Dry Weight of Live,
Lower Mekong Basin: A Decision Approach,	CategoryEffluent Guidelines and Standards.	Unanesthetized Fish by Photography,
W76-05762 6A	W76-06085 5G	W76-05615 5A
EDINBURGH CORP., (SCOTLAND).	Plastics and Synthetics Point Source Category	The Impact of Timber Harvest, Fertilization,
Edinburgh's Sewage-Treatment and Disposal	(Proposed Effluent Limitations and	and Herbicide Treatment on Streamwater
Scheme,	Guidelines).	Quality in Western Oregon and Washington, W76-05618 5B
W76-05794 5D	W76-06086 5G	W76-05618 5B

Nutrient Cycling in 37- and 450-Year-Old	FRESHWATER BIOLOGICAL ASSOCIATION,	Areas, Southern Nassau County, Long Island, New York,
Douglas-Fir Ecosystems, W76-05619 5B	WAREHAM (ENGLAND). RIVER LAB. Notes on the Production of Stream Bryophytes	W76-05858 70
Guidelines for Characterizing Naturally Unsta- ble or Potentially Unstable Slopes on Western	in the High Pyrenees (France), W76-06129 2I	GEOLOGICAL SURVEY, RALFIGH, N.C. Sediment Characteristics of Streams in the
National Forests,	FUJI PHOTO FILM CO., LTD., KANAGAWA	Eastern Piedmont and Western Coastal Plair
W76-05621 4D	(JAPAN). (ASSIGNEE). Method of Treating Waste Liquids from Photo-	Regions of North Carolina, W76-05849
Soil Microbes,	graphic Processings,	GEOLOGICAL SURVEY, RESTON, VA.
W76-05935 2G	W76-05963 5D	Equations for Resistance to Flow and Sedimen
Soil Processes and Introduced Chemicals,	GARY AIRCRAFT CORP. SAN ANTONIO, TEX.	Transport in Alluvial Channels,
W76-05936 4C	(ASSIGNEE).	W76-05844 2.
Soil Stability and Water Yield and Quality,	Process for Biochemical Reactions,	Application of Multi-Regional Planning Models
W76-05937 4D	W76-05542 5D	to the Scheduling of Large-Scale Water
Effects of Forest Fertilization with Urea on	GASTON COUNTY DYEING MACHINE CO.	Resource Systems Development, W76-05846 6A
Stream Water QualityQuilcene Ranger Dis-	MOUNT HOLLY, N. C. (ASSIGNEE).	W 70-03840
trict, Washington,	Filtering Apparatus and Process, W76-05546 5D	GEOLOGICAL SURVEY, SACRAMENTO,
W76-05938 5B	1170 03340	CALIF.
Demand for Dissolved Oxygen Exerted by	GEOLOGICAL SURVEY, BATON ROUGE, LA.	Land Subsidence and Aquifer-System Compaction in the San Jacinto Valley, Riverside Coun
Finely Divided Logging Debris in Streams,	Geohydrology of the Evangeline and Jasper	ty, CaliforniaA Progress Report,
W76-05939 4C	Aquifers of Southwestern Louisiana, W76-05861 2F	W76-05847 21
Effect of Cacodylic Acid and MSMA on		GEOLOGICAL SURVEY, TACOMA, WASH.
Microbes in Forest Floor and Soil,	GEOLOGICAL SURVEY, BAY SAINT LOUIS,	Table of Data on Water Quality of Baker Lake
W76-05940 5C	MISS. Steady-State Segmented Dissolved-Oxygen	near Mount Baker, Washington,
Geology and Geomorphology of the H. J. An-	Model,	W76-05857 70
drews Experimental Forest, Western Cascades,	W76-05855 5B	GEOLOGICAL SURVEY, TALLAHASSEE, FLA
Oregon,	CEGLOCICAL SUBVEY BOSTON MASS	Relation of Water Level and Fish Availability
W76-05941 4D	GEOLOGICAL SURVEY, BOSTON, MASS. Evaluation of Data Availability and Examples	to Wood Stork Reproduction in the Southern
Timber Production and Water Quality	of Modeling for Ground-Water Management on	Everglades, Florida, W76-05850 2
Progress in Planning for the Bull Run, Portland,	Cape Cod, Massachusetts,	W 76-03830 2
Oregon's Municipal Watershed, W76-05942 5B	W76-05856 4B	Floridan Aquifer in Northeast Florida-Three
11.0-03742	GEOLOGICAL SURVEY, CONCORD, N.H.	MapsHardness of Water, Chloride Concentra
Impact of Forest Fertilization on Water Quality	Availability of Ground Water in the Androscog-	tion, and Potentiometric Surface, May 1974, W76-05859
in the Douglas-Fir Region A Summary of Monitoring Studies,	gin River Basin, Northern New Hampshire,	11.00000
W76-05943 5B	W76-05862 7C	GEOLOGICAL SURVEY, TUCSON, ARIZ.
	GEOLOGICAL SURVEY, HARRISBURG, PA.	Relation of the Consumptive Use Coefficient to the Description of Vegetation,
Slope Stability Problems Associated with Timber Harvesting in Mountainous Regions of	Limnological Data for the Major Streams in	W76-05843 2I
the Western United States,	Chester County, Pennsylvania,	
W76-05944 4C	W76-05852 7C	GEOLOGICAL SURVEY, VERMILLION, S. D. Geology and Water Resources of Charles Mi
Basticida Basidus Dunamias in a Forest	Sediment Characteristics of Five Streams Near	and Douglas Counties, South Dakota, Part 1
Pesticide Residue Dynamics in a Forest Ecosystem: A Compartment Model,	Harrisburg, Pennsylvania, Before Highway	Geology,
W76-05946 5B	Construction, W76-05854 4C	W76-05923 4/
Interpreting Stability Dealthan for the Land	W 70-03834 4C	GKY AND ASSOCIATES, ALEX., VA.
Interpreting Stability Problems for the Land Manager,	GEOLOGICAL SURVEY, HELENA, MONT.	Decision Perspectives on Urban Storm Wate
W76-05947 4D	Water-Resources Investigations of the U.S.	Pollution,
Dead Carelled - Care Tree is in the Deading	Geological Survey in the Northern Great Plains Coal Region of Eastern Montana, 1975-76,	W76-05509 51
Road Standards on Steep Terrain in the Pacific Northwest U.S.A. with Suggestions for Imple-	W76-05853 7C	GOVIND BALLABH PANT UNIV. OF
mentation,	GEOLOGICAL CURVEY MARKET WAS	AGRICULTURE AND TECHNOLOGY,
W76-05948 4C	GEOLOGICAL SURVEY, MADISON, WIS. A Digital-Computer Model for Estimating	PANTNAGAR (INDIA). DEPT. OF SOIL
Dicamba Residues in Streams After Forest	Hydrologic Changes in the Aquifer System in	SCIENCE. Evaporation Characteristics of Three Fine-Tex
Spraying,	Dane County, Wisconsin,	tured Tarai Soils Under Various Evaporation
W76-05949 5B	W76-05851 2F	Potentials,
The Forest Ecosystem of Southeast Alaska 5.	GEOLOGICAL SURVEY, MENLO PARK,	W76-06037
Soil Mass Movement,	CALIF.	GREAT CANADIAN OIL SANDS LTD.,
W76-05950 4D	Late Pleistocene and Holocene Depositional	TORONTO (ONTARIO). (ASSIGNEE).
FOREST SERVICE (USDA), OXFORD, MISS.	Trends, Processes, and History of Astoria	Method of Reducing Sludge Accumulatio
SOUTHERN FOREST EXPERIMENT STATION.	Deep-Sea Fan, Northeast Pacific, W76-05845 2L	from Tar Sands Hot Water Process, W76-05965 51
Harvesting Southern Forests: A Threat to		
Water Quality,	Selected Water-Quality Data from Fallen Leaf	Recovering Bitumen from Large Water Su
W76-05945 5B	Lake, El Dorado County, California, June through October 1974.	faces, W76-05992
FOREST SERVICE (USDA). SOUTHERN	W76-05848 7C	
FOREST EXPERIMENT STATION.		GUELPH UNIV. (ONTARIO). CENTRE FOR
Pine Management Influences the Southern Water Resource,	GEOLOGICAL SURVEY, MINEOLA, N.Y. Hydrogeochemical Data from Investigation of	RESOURCES DEVELOPMENT. Hanlon Creek Ecological Study, Phase B.
W76-05616 5B	Water Quality in Sewered and Unsewered	W76-05650 6
The second secon	The state of the s	

HARRIS (FREDERICK R.), INC., NEW YORK. Port Collection and Separation Facilities for	ILLINOIS STATE WATER SURVEY, URBANA. Chemistry of Mud-Water Interface in an Im-	Population of Dugongs (Dugong Dugon (Muller)).
Oily Wastes. Vol. 5. A Comparative Analysis of Conceptual System Plans for the Surveyed	poundment,	W76-06131 2L
Ports Under the 'No Discharge', '1969 Amend-		JODHPUR UNIV. (INDIA). DEPT. OF BOTANY.
ments' and 'No Sheen' Criteria, W76-05830 5D	ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.	Role of Phenylmercuric Acetate on Stomatal Regulation and Water Loss in Prosopis
HARYANA AGRICULTURAL UNIV., HISSAR	Compilation of Methodology used for Measur- ing Pollution Parameters of Sanitary Landfill	Cineraria Linn, W76-06011 5G
(INDIA). Climatic Water Balance at Hissar,	Leachate,	JOHNS HOPKINS UNIV., BALTIMORE, MD.
W76-06041 2B	W76-05869 5A	The Fate of Nutrients in Back River,
HAWAN INN HONOLULU	ILLINOIS UNIV. AT URBANA-CHAMPAIGN.	W76-05625 5C
HAWAII UNIV., HONOLULU. Conditional Expected Tsunami Inundation for	DEPT. OF FORESTRY.	JOHNS HOPKINS UNIV., BALTIMORE, MD.
Hawaii.	Flood-Caused Tree Mortality Around Illinois Reservoirs.	DEPT OF GEOGRAPHY AND
W76-05920 8B	W76-06027 4A	Environmental Responses to Thermal
HAWAII UNIV., HONOLULU. DEPT. OF	INCINERATOR CO., HUNTINGTON	Discharges from Marshall Steam Station, Lake
A Non-Adapted Vegetation Interferes with	(ENGLAND).	Norman, North Carolina, W76-05870 5C
Water Removal in a Tropical Rain Forest Area	Incineration's Role in Ultimate Disposal of Process Wastes,	
in Hawaii,	W76-05791 5E	Introduction and Physical Description of Lake Norman,
W76-06042 4A	INDIAN INCT. OF CCIENCE BANCALORE	W76-05871 5C
HAZEN AND SAWYER, NEW YORK.	INDIAN INST. OF SCIENCE, BANGALORE. DEPT. OF BIOCHEMISTRY.	Thermal and Water Quality Characteristics of
Brooklyn Plant Meets Major Challenges, W76-05768 5D	Factors in the Purification of Flowing Sewage	Lake Norman,
	and Activated Sludge Process, Part I, W76-05795 5D	W76-05872 5C
HELSINKI UNIV. OF TECHNOLOGY,	W /6-03/93	Plankton Populations,
OTANIEMI FINLAND. Position of a Calcium Bisulfite Pulp Mill Par-	INDUSTRIAL SCIENCE AND TECHNOLOGY,	W76-05873 5C
ticularly with Respect to Intensified Environ-	TOKYO (JAPAN). (ASSIGNEE).	Primary Production,
mental Protection Requirements (Die Position	Method of Preventing Scale From Being Deposited In Case of Producing Fresh Water	W76-05874 5C
einer Kalziumbisulfitfabrik, besonders im Hin- blick auf verschaerfte Umweltschutzforderun-	From Sea Water,	The Effect of Thermal Discharge on the Rate
gen),	W76-05971 3A	of Accumulation of Organic Substances on
W76-05722 5G	INSTITUT NATIONAL DE LA RECHERCHE	Glass Surfaces Immersed in Lake Norman,
HENNINGSON, DURHAM AND RICHARDSON,	SCIENTIFIQUE, RIMOUSKI (QUEBEC).	W76-05875 5C
INC., OMAHA, NEBR.	Correction of Bias in the Estimation of the	Zooplankton Entrainment,
Operational Practices to Upgrade Trickling	Coefficient of Skewness, W76-05910 2E	W76-05876 5C
Filter Plant Performance, W76-05781 5D		Benthic Invertebrates,
	INSTITUT NATIONAL DE LA SANTE ET (DE)	W76-05877 5C
HOBART AND WILLIAM SMITH COLL.,	LA RECHERCHE MEDICALE, PARIS (FRANCE).	Fisheries Research,
GENEVA, N. Y. DEPT. OF CHEMISTRY. Mercury in Sediments of the Horwer Bucht	Application of Factorial Analysis of Principal	W76-05878 5C
(Lake Lucerne) and Tributary Streams, Swit-	Components to the Control of Pollution of Sur-	JOHNS-MANVILLE CORP., DENVER, COLO.
zerland,	face Waters, W76-05632 5B	(ASSIGNEE).
W76-06136 5A		Impact Sprinkler,
HOOKER CHEMICALS AND PLASTICS CORP.,	INSTITUTE OF PUBLIC ADMINISTRATION, NEW YORK.	W76-05956 3F
NIAGARA FALLS, N. Y. Bleach Plant Pollution Abatement Where Do	Criteria for Evaluation of Social Impacts of	JONES AND HENRY ENGINEERS, LTD.,
We Stand,	Flood Management Alternatives,	TOLEDO, OHIO. Supernatant Doesn't Have to Ruin Effluent
W76-05719 5D	W76-05653 6B	Quality,
HOUSTON UNIV., TEX.	INSTITUTE OF TROPICAL METEOROLOGY,	W76-05772 5D
An Economic Model of Water Use and Waste	POONA (INDIA).	KANSAS STATE UNIV., MANHATTAN. DEPT.
Treatment, W76-05814 5D	Trend Analysis of Annual Indian Rainfall, W76-05691 2B	OF AGRONOMY.
		Interactions of Mercury with Aquatic and Edaphic Environments,
HYDROBIOLOGICAL RESEARCH STATION,	INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA).	W76-05601 5B
MADRAS (INDIA). Limnological Features of a Tropical Impound-	The Reliability of Mercury Analysis in En-	KANSAS UNIV., LAWRENCE. DEPT. OF
ment, Bhavanisagar Reservoir (Tamil Nadu),	vironmental Materials,	GEOLOGY.
India,	W76-06007 5A	Trace Element, Mineralogy, and Size Distribu-
W76-06020 5C	IOWA COOPERATIVE FISHERY UNIT, AMES.	tion of Suspended Material Samples from Selected Rivers in Eastern Kansas.
HYDROGEOLOGICAL CONSULTANTS LTD.,	Accumulation and Elimination of Dieldrin by	W76-05606 5B
EDMONTON (ALBERTA). Yukon City's New Well Replaces Five Older	Channel Catfish (Ictalurus Punctatus), W76-05642 5C	KARLSRUBE UNIV. (WEST GERMANY).
Ones,		INSTITUT FUER WASSERBAU III.
W76-05566 4B	IOWA STATE UNIV., AMES. Control of Nitrogen Transformations in Soils,	Simulation as a Tool in International River
ICHTHYOLOGICAL ASSOCIATES, INC.,	W76-05608 5B	Development, W76-05757 6A
DRUMORE, PA.		
Food Habits of the Rough Shiner, Notropis Baileyi Suttkus and Raney, in Halawakee	JAMES COOK UNIV., OF NORTH QUEENSLAND, TOWNSVILLE (AUSTRALIA).	KELMIK, INC., EAST LANSING, MICH. (ASSIGNEE).
Creek, Alabama,	Effects of a Tropical Cyclone on Littoral and	Liquid Purifying Process,
W76-06126 2I	Sub-Littoral Biotic Communities and on a	W76-05528 5D

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KENTUCKY UNIV., LEXINGTON. DEPT. OF	MAGYAR TUDOMANYOS AKADEMIA,	MICHIGAN STATE UNIV., EAST LANSING.
AGRICULTURAL ENGINEERING.	BUDAPEST (HUNGARY).	AGRICULTURAL EXPERIMENT STATION.
Using Parametric Models of Runoff to Improve Parameter Estimates for Stochastic Models,	The Role of Inland Navigation in River Basin	Overwintering of Evergreens in Plastic Struc-
W76-05911 2E	Development, W76-05511 4A	tures, W76-06014 2I
KENTUCKY WATER RESOURCES RESEARCH	MAIN (CHARLES T.), INC., BOSTON, MASS.	MICHIGAN UNIV., ANN ARBOR.
INST., LEXINGTON.	Electrolytic Coagulation of Lignin from Kraft	Geochronology of Lake Michigan Sediments:
Supply and Demand in Water Planning: Streamflow Estimation and Conservational	Mill Bleach Plant Wastewaters, W76-05708 5D	Anomalies in Lead-210 Distributions, W76-05885 5B
Water Pricing, W76-05607 6D	MACCHINENEARRY ANDRITZ A C CDAZ	MICHICAN FINITE ANN ARROR CREAT
	MASCHINENFABRIK ANDRITZ A. G., GRAZ (AUSTRIA).	MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.
KHATAULI MANURE MILLS, KHATAULI	Experiences and Possibilities with the Andritz-	Lake and Shore Ice Conditions on Southeast-
(INDIA). Behaviour of Some Phosphatic Fertilizers in	Sem Double Wire Press for Sludge Dewatering,	ern Lake Michigan in the Vicinity of the
Water,	Particularly in the Paper, Pulp and Board In-	Donald C. Cook Nuclear Plant: Winter 1973-74,
W76-06139 5B	dustry (Erfahrungen und Moeglichkeiten mit	W76-05664 2C
KINNERET LIMNOLOGY LAB., TIBERIAS	der Andritz-Sem Doppelsiebpresse bei der	MINISTRY OF FOREST AND WATER
(ISRAEL).	Schlamment-waesserung, insbesondere in der Papier-, Zellstoff-und Karto	MANAGEMENT, PRAGUE
Phosphorus, Nitrogen, and the Growth of	W76-05729 5E	(CZECHOSLOVAKIA).
Algae in Lake Kinneret,		The Czechoslovak Water Development
W76-05633 5C	MASSACHUSETTS UNIV., AMHERST. DEPT.	Planning Approach and Its Application,
KIRKHAM MICHAEL AND ASSOCIATES,	OF GEOLOGY AND GEOGRAPHY.	W76-05749 6A
OMAHA, NEBR.	Equilibrium-Line Altitudes, Mass Balance, and	MITRE CORP., MCLEAN, VA.
New System Puts the Wood to Wastewater,	July Freezing-Level Heights in the Canadian High Arctic,	Impacts of Hydrologic Modification on Water
W76-05586 5D	W76-05682 2C	Quality,
LAMONT-DOHERTY GEOLOGICAL		W76-05866 5G
OBSERVATORY, PALISADES, N.Y.	MASSACHUSETTS UNIV., WALTHAM. DEPT.	MONAGRANIA CLANTON (ALICTRALIA)
Chemically Enhanced C02 Gas Exchange in a	OF ENVIRONMENTAL SCIENCES.	MONASH UNIV., CLAYTON (AUSTRALIA). DEPT. OF ZOOLOGY.
Eutrophic Lake: A General Model,	Statistical Study of the Duckweed Rhizosphere	Distribution of Fish in Inland Saline Waters in
W76-05635 5C	as an Eco-Assay Tool, W76-05605 5B	Victoria, Australia,
LANCASTER UNIV., BAILRIGG (ENGLAND).	W 76-03603	W76-06143 2H
DEPT. OF BIOLOGICAL SCIENCES.	MCGILL UNIV., MONTREAL (QUEBEC).	
Detection and Preliminary Identification of En-	DEPT. OF PHYSICS.	Dynamics of Benthic Invertebrates in a Tropi-
dogenous Antitranspirants in Water-Stressed	Statistics of Raingage Data,	cal Man Made Lake (Volta Lake 1964-1968):
Sorghum Plants, W76-06026 2I	W76-05693 2B	Standing Crop and Bathymetric Distribution, W76-06144 5C
W /0-00020 21	MEDICAL COLL. OF WISCONSIN,	W 70-00144
LATVIAN SCIENTIFIC RESEARCH INST. OF	MILWAUKEE, DEPT, OF PHARMACOLOGY.	MONTCLAIR STATE COLL., UPPER
HYDRAULIC ENGINEERING AND	Glucuronide Formation in Rainbow Trout: Ef-	MONTCLAIR, N.J. DEPT. OF BIOLOGY.
RECLAMATION, JELGANA (USSR). Flood Routing in Channel Systems with Al-	fect of Salicylamide on the Acute Toxicity,	Acute Toxicity of a Native Mummichog Popu-
lowance for Bank Regulation,	Conjugation and Excretion of 3-	lation (Fundulus Heteroclitus) to Mercury, W76-05742 5C
W76-05668 4A	Trifluoromethyl-4-Nitrophenol,	W76-05742 5C
LEPPA CHUI (PUGLANE) MELLOCATE	W76-06031 5C	MONTGOMERY (JAMES M.), INC.,
LEEDS UNIV. (ENGLAND). WELLCOME MARINE LAB.	METCALF AND EDDY, INC., BOSTON, MASS.	PASADENA, CALIF. WATER TREATMENT
The Combined Effects of High Salinity and	Awt Plant is Top Performer,	DIV.
Temperature on the Survival of Young Liman-	W76-05769 5D	Design and Operation of High-Rate Filters-
da Limanda,		Part 2, W76-05831 5D
W76-06148 5C	METROPOLITAN SANITARY DISTRICT OF	W76-05831 5D
LETHBRIDGE UNIV. (ALBERTA). DEPT. OF	GREATER CHICAGO, ILL. DEPT. OF RESEARCH AND DEVELOPMENT.	Design and Operation of High-Rate Filters
GEOGRAPHY.	Biological Nitrification of Sludge Supernatant	Part 3,
Sublimation or Melting: Observations from the	by Rotating Disks,	W76-05832 5F
White Mountains, California and Nevada,	W76-05800 5D	MONTREAL UNIV. (QUEBEC). DEPT. OF
U.S.A., W76-05683 2C	METROPOLITAN TORONTO DEPT. OF	MATHEMATICS.
W 70-03083 2C	WORKS (ONTARIO). WATER POLLUTION	A Stochastic Model of Dispersion of Sediment
LOUIS SCHLEIFFER A. G., FELDBACH	CONTROL DIV.	Particles Released from A Continuous Source,
(SWITZERLAND). (ASSIGNEE).	Toronto's Approach to Preventive Maintenance	W76-05663 2J
Apparatus for the Separation of Liquid Mix- tures My Means of Permeability Selective	for Treatment Plants,	MOUNT ATTION UNIT CACKUITE NEW
Separation Membranes,	W76-05780 5F	MOUNT ALLISON UNIV., SACKVILLE (NEW
W76-05991 3A	MIAMI UNIV., CORAL GABLES, FLA. DEPT.	BRUNSWICK). DEPT. OF BIOLOGY. Seasonal Dynamics and Productivity of Tany-
	OF BIOLOGY.	tarsus Barbitarsis Freeman
LOUISIANA STATE UNIV., BATON ROUGE. LAW SCHOOL.	Differential Responses to Drought in Two Spe-	(Diptera:Chironomidae) in the Benthos of a
Coastal Zone Management and Intergovern-	cies of Fundulus,	Shallow, Saline Lake,
mental Coordination,	W76-06132 2H	W76-06142 5C
W76-06057 6E	MICHIGAN DEPT. OF NATURAL RESOURCES	MUNICIPAL ENVIRONMENTAL RESEARCH
LYCOMING COUNTY PLANNING	E. LANSING. WATER RESOURCES	LAB., CINCINNATI, OHIO.
COMMISSION, WILLIAMSPORT, PA.	COMMISSION.	Interim Report on the Impact of Public Law 92-
Protecting Groundwater from Landfill	Michigan Wastewater Reporting and Surveil-	500 on Municipal Pollution Control Technolo-
Leachate,	lance Fees Rules.	gy.
W76-05599 5G	W76-06067 5G	W76-05867 5D

NAGOYA UNIV. (JAPAN). WATER RESEARCH LAB.	NATIONAL WATER AUTHORITY, BUDAPEST (HUNGARY). WATER POLLUTION CONTROL.	DEPT. OF CITY AND REGIONAL PLANNING.
Changes in the Limnological Features of a Meromictic Lake Suigetsu During the Years, 1926-1967,	Recent Trends in Water Quality Management and Protection in Hungary, W76-05518 5G	Management of Environmental Quality: Obser- vations on Recent Experience in the United States and the United Kingdom,
W76-06018 2H	NATIONAL WATER QUALITY LAB., DULUTH,	W76-05659 5G
NAGS HEAD TOWN COUNCIL, NAGS HEAD,	MINN; AND ENVIRONMENTAL RESEARCH	NORTH DAKOTA STATE UNIV., FARGO.
N.C.	LAB., DULUTH, MINN.	DEPT. OF SOILS.
Certain Land Use Regulations to Protect from	Comparative Toxicity of Polyelectrolytes to Selected Aquatic Animals.	Spatial Variability of in Situ Unsaturated
Danger of Flooding. W76-06059 6F	W76-05740 5C	Hydraulic Conductivity of Maddock Sandy Loam,
	NATIONAL WATER WELL ASSOCIATION,	W76-05670 2G
NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D.C.; NATIONAL	WORTHINGTON, OHIO.	NORTHERN GREAT PLAINS RESOURCES
COMMITTEE FOR THE INTERNATIONAL	History of Ground Water Concepts,	PROGRAM, DENVER, COLO.
HYDROLOGICAL DECADE, WASHINGTON,	W76-05551 2F	Northern Great Plains Resource Program.
D.C.	History of Ground Water Development,	W76-06050 6D
Nuclear Techniques in HydrologyCurrent Status and Prospective Uses.	W76-05556 4B	OAK RIDGE NATIONAL LAB., TENN.
W76-05922 5A	NATIONAL WEATHER SERVICE FORECAST	Cross-Flow Filtration and Axial Filtration,
NATIONAL PIPER NAVIGORICA TIONS	OFFICE, WASHINGTON, D. C.	W76-05788 5D
NATIONAL FIELD INVESTIGATIONS CENTER, DENVER, COLO.	Hydrologic Implications of Canyon Dam and Reservoir.	OAK RIDGE NATIONAL LAB., TENN.
Report on Water Quality and Waste-Source In-	W76-05503 2H	ENVIRONMENTAL SCIENCES DIV.
vestigations, Big Sioux River and Selected	NATIONAL WEATHER SERVICE, SILVER	Biological Denitrification and its Application in Treatment of High-Nitrate Waste Water,
Tributaries. W76-05626 5C	SPRING, MD.; AND GEOLOGICAL SURVEY,	W76-05792 5D
W 76-03626	RESTON, VA.	OPPICE OF THE COCRPTABL (VALUE)
NATIONAL INST. OF HYGIENE, WARSAW	The 1973 Mississippi River Basin Flood: Com- pilation and Analyses of Meteorologic, Stream-	OFFICE OF THE SECRETARY (NAVY), WASHINGTON, D. C. (ASSIGNEE).
(POLAND). DEPT. OF COMMUNAL HYGIENE. Limnological Character of Experimental Reser-	flow, and Sediment Data,	Line Motion and Water Current Disc Sensor,
voirs Treated with Tritox 30% (DDT, DMDT,	W76-05860 2E	W76-05539 7B
GAMMA HCH),	NAUCHNO-ISSLEDOVATEL'SKII INSTITUT	OFFICE OF THE SECRETARY OF THE ARMY,
W76-06012 5C	SANITARNOI TEKHNIKI I OBORUDOVANIA	WASHINGTON, D. C. (ASSIGNEE).
NATIONAL OCEANIC AND ATMOSPHERIC	ZDANII I SOORUZHENII, KIEV (USSR).	Process for Treating Waste Water Containing
ADMINISTRATION, WASHINGTON, D.C.	Control of Coagulant Recovery from Effluent Sediment (Kontrol' regeneratsii koagulyantov	Cellulose Nitrate Particles, W76-05575 5D
Coastal Zone Management Program Develop-	iz osadka ctochnykh vod),	W 10-03575
ment Grant. W76-06095 6E	W76-05725 5E	OLD DOMINION UNIV., NORFOLK, VA. DEPT.
W70-00093	NEW ENGLAND RIVER BASINS	OF GEOPHYSICAL SCIENCES. Vertical Electrical Resistivity Soundings to
NATIONAL RESEARCH COUNCIL OF	COMMISSION, BOSTON, MASS.	Locate Ground Water Resources: A Feasibility
CANADA, SASKATOON (SASKATCHEWAN) PRAIRIE REGIONAL LAB.	SOUTHEASTERN NEW ENGLAND STUDY.	Study,
Yeasts Isolated from Some Lakes and Rivers	How to Guide Growth in Southeastern New England, Parts I, II and IV of the Draft Report.	W76-05835 4B
of Saskatchewan,	W76-05649 6G	ONTARIO MINISTRY OF THE
W76-06135 5B	NEW YORK STATE COLL. OF	ENVIRONMENT, TORONTO. APPLIED
NATIONAL SWEDISH ENVIRONMENT	AGRICULTURE, ITHACA. DEPT. OF	SCIENCE SECTION. Movement of Tracers Through Soil,
PROTECTION BOARD, STOCKHOLM.	POMOLOGY.	W76-05701 5B
WALLENBERG-LAB. Ion Exchange Technique for the Determination	Grapevine Response to Furrow and Trickle Irrigation,	E Bi
of Chlorinated Phenols and Phenoxy Acids in	W76-06032 3F	Energy Requirements for Conventional and Advanced Wastewater Treatment.
Organic Tissue, Soil, and Water,	NEW YORK STATE DEPT. OF	W76-05702 5D
W76-06122 5A	ENVIRONMENTAL CONSERVATION,	OREGON UNIV., EUGENE. DEPT. OF
NATIONAL WATER AUTHORITY, BUDAPEST	DELMAR. WILDLIFE RESEARCH LAB.	ECONOMICS.
(HUNGARY).	Stream Bed Stabilization in Enfield Creek, New York.	Efficiency in Water Quality Control for the
Water Management Control System for the	W76-06145 8I	Willamette River,
Zagyva-Tarna River Basin, W76-05746 4A	NEW YORK STATE DEPT. OF HEALTH,	W76-05658 5G
	ALBANY. ENVIRONMENTAL HEALTH	OREGON UNIV., EUGENE. DEPT. OF
Technical-Economic Planning of the Gab- cikovo-Nagymaros Barrage Project for the	CENTER.	GEOLOGY. Impact of Clear-Cutting and Road Construction
Development of the Central-Danube Basin,	Effects of Salinity on Nitrification in the East	on Soil Erosion by Landslides in the Western
W76-05754 4A	River, W76-05631 5C	Cascade Range, Oregon,
Legal Framework of Co-Operation in the Field		W76-05614 4C
of Water Management Between Hungary and	NICOLAS COPERNICUS UNIV. OF TORUN (POLAND). LAB. OF MICROBIOLOGY.	OREGON UNIV., EUGENE. SCHOOL OF LAW.
Her Neighboring Countries,	Generic Composition and Nutritional Require-	The Taking Issue: Potential Obstacle to natural
W76-05759 6E	ments of Bacteria Isolated from Three Lakes,	Resource Management Legislation, W76-06055 6E
NATIONAL WATER AUTHORITY, BUDAPEST	W76-06120 2H	
(HUNGARY). DEPT. OF WATER	NIPPON ELECTRIC CO. LTD. TOKYO	OREGON UNIV., PORTLAND.
MANAGEMENT POLICY. Long Range Planning of Water Resources: A	(JAPAN). (ASSIGNEE). Method of Extracting Heavy Metals from In-	Analysis of Pulp and Paper Mill Waste Waters by High-Resolution Ion-Exchange Chromatog-
Multi Objective Approach,	dustrial Waste Waters,	raphy,
W76-05760 6A	W76-05966 5D	W76-05709 5A

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OSLO UNIV. (NORWAY). DEPT. OF	PLATTE TECHNICAL COMMUNITY COLL.,	RIJKSINSTITUUT VOOR
LIMNOLOGY, AND OSLO UNIV. (NORWAY). INST. OF MARINE BIOLOGY.	COLUMBUS, NEBR. The Microenvironment of Climacium Amer-	DRINKWATERVOORZIENING, THE HAGUE
Macrovegetation and Ecological Factors in	icanum,	(NETHERLANDS). Cause and Identification of Taste and Odour
Two Norwegian Lakes, W76-06044 5C	W76-06045 2G	Compounds in Water, W76-06009 5A
W 70-00044	POLISH ACADEMY OF SCIENCES, WARSAW.	W 70-00009 3A
OTTAWA-CARLETON REGIONAL MUNICIPALITY (ONTARIO).	INST. OF EXPERIMENTAL BIOLOGY. Biology and Bioenergetics of Grass Carp	RIST-FROST ASSOCIATES, GLENS FALLS, N.
The Master Plan for Water Supply in the Re-	(Ctenopharyngodon Idella Val.),	Y. DEPT. OF ENVIRONMENTAL ENGINEERING.
gional Municipality of Ottawa-Carleton,	W76-06013 2I	This Plant Can Use 5 Sludge Processes,
W76-05815 6D	POLITECNICO DI MILANO (ITALY).	W76-05798 5D
OTTAWA UNIV. (ONTARIO).	ISTITUTO DI ELETTROTECNICA ED	DOCK WALLEY WAREN CONDITIONING
Proposal for a Trans-Mediterranean Aqueduct,	ELETTRONICA.	ROCK VALLEY WATER CONDITIONING,
W76-05660 4A	Reservoir Management Via Reliability Pro- gramming,	INC., ROCKFORD, ILL. (ASSIGNEE). Multi-Tank Ion Exchange Water Treatment
PACIFIC NORTHWEST ENVIRONMENTAL	W76-05508 . 4A	System,
RESEARCH LAB., CORVALLIS, OREG.	PORT ELIZABETH UNIV. (SOUTH AFRICA).	W76-05975 5F
Relationships Between Drainage Area Charac- teristics and Non-Point Source Nutrients in	DEPT. OF ZOOLOGY.	ROYAL VETERINARY AND AGRICULTURE
Streams.	Notes on the Biology of Some Estuarine	COLL., COPENHAGEN (DENMARK).
W76-05624 5B	Bivalves,	HYDROTECHNICAL LAB.
	W76-06134 2L	Water and Phosphate Transport to Plant Roots, W76-06002 2I
PAPIERTECHNISCHE STIFTUNG, MUNICH	PUBLIC SERVICE ELECTRIC AND GAS CO.,	W 76-06002 21
(WEST GERMANY). Experiments on the Optimization of Sludge De-	NEWARK, N. J. RESEARCH AND	SASKATCHEWAN UNIV., SASKATOON.
watering and on the Use of Bark and Sludge in	DEVELOPMENT DEPT.	Optimizing Organic Carbon and Color Removal
the Brick Industry (Versuche Zur Optimierung	Food of Tarakihi in Western Bay of Plenty and	from a Board Mill Effluent,
der Schlammentwaesserung und zur Verwer-	Tasman Bay, New Zealand,	W76-05724 5D
tung von Rinde und Schlamm in der Ziegelin-	W76-06047 2L	ALON AND THE STATE OF THE STATE
dustrie),	PURDUE UNIV., LAFAYETTE, IND. DEPT. OF	SASKATCHEWAN UNIV., SASKATOON. DEPT. OF SOIL SCIENCE.
W76-05704 5D	ENVIRONMENTAL ENGINEERING.	Carbon Dioxide Evolution from Virgin and Cul-
PARSONS, BRINCKERHOFF, QUADE AND	Detergent Phosphate Ban Yields Little	tivated Soil as Affected by Management Prac-
DOUGLAS, INC., NEW YORK.	Phosphorus Reduction, Part I, W76-05637 5C	tices and Climate,
Rehabilitating an 80-Year Old Sewer System,	W 70-03037	W76-06003 2G
W76-05764 5D	QUEBEC UNIV., MONTREAL. DEPT. OF	
	PHYSICS.	SCRIPPS INST. OCEANOGR., LA JOLLA,
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.	On Radar-Raingage Comparison,	CALIF. SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.
Municipal Wastewater Odor Still a Problem	W76-05694 2B	The Deposition of Molybdenum in Anoxic
Part 1,	QUEEN'S UNIV., BELFAST (NORTHERN	Waters,
W76-05773 5D	IRELAND). DEPT. OF AGRICULTURAL AND FOOD CHEMISTRY.	W76-05996 2K
PENNSYLVANIA STATE UNIV., UNIVERSITY	Some Relations Between Forest Litter and	SHELL OIL CO., HOUSTON, TEX.
PARK. INST. FOR RESEARCH ON LAND AND	Growth of Sitka Spruce on Poorly Drained	(ASSIGNEE).
WATER RESOURCES.	Soils,	Removal of Floating Pollutants,
Proceedings - Conference on Water Conserva-	W76-05687 2I	W76-05533 5G
tion and Sewage Flow Reduction with Water-	QUEEN'S UNIV., KINGSTON (ONTARIO).	
Saving Devices. W76-05602 5D	QUURM - A Realistic Urban Runoff Model,	SIMON FRASER UNIV., BURNABY (BRITISH
W76-05602 5D	W76-05577 2A	COLUMBIA). DEPT. OF BIOLOGICAL
PERMUTIT CO., PARAMUS, N.J. (ASSIGNEE).		SCIENCES. Influences of Some Freshwater Plants on the
Method of Operating Ion Exchange System,	RENSSELAER POLYTECHNIC INST., TROY,	Development and Survival of Mosquito Larvae
W76-05983 5F	N. Y. FRESH WATER INST. A Description of the Trophic Status and	in British Columbia,
PETROCHEMICALS CO. INC., FORT WORTH,	Nutrient Loading for Lake George, New York,	W76-06048 5G
TEX.	W76-05638 5C	COCUMA IN LANGE BOOK OF THE COLUMN ASSESSMENT
PVC Pipe in Water Distribution: Reliability and	BECEARCH INCT. EAR WATER RECOURCES	SOCIETA ITALIANA RESINE S.P.A., MILAN
Durability,	RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).	(ITALY). (ASSIGNEE).
W76-05552 8G	Goals and Forms of Co-operation Among	Multistage Flash Evaporator for Producing Soft Water from a Saline Water.
BETROLITE CORR OF LOUIS WO	Countries for the Development of International	W76-05978 3A
PETROLITE CORP., ST. LOUIS, MO. (ASSIGNEE).	River Basins,	11.005510
Use of Polymeric Quaternary Ammonium	W76-05521 4A	SOIL CONSERVATION SERVICE, RICHMOND,
Betaines as Water Clarifiers,	Evaluation of the Effects of Water Transfer,	VA.
W76-05544 5F	W76-05751 6A	Flood Hazard Analyses: Buffalo River, Am-
BUILDING OF ORDER AND AND ADDRESS AND		herst County, Virginia.
PHILIPS GLOEILAMPENFABRIEKEN N.V., EINDHOVEN (NETHERLANDS).	RESEARCH INST. FOR WATER RESOURCES	W76-05643 4A
A Coulometric Device for Measuring Total Ox-	DEVELOPMENT, BUDAPEST (HUNGARY).	Flood Hazard Analyses: Blacks Run-Cooks
ygen Demand,	WATER QUALITY AND TECHNOLOGY DEPT. Nematodes of Lake Balaton: IV. Seasonal	Creek, Rockingham County and Harrisonburg,
W76-05728 5A	Qualitative and Quantitative Changes,	Virginia.
BUILDE OF ORD AMBERTARDINGS ST.	W76-06004 5C	W76-05644 4A
PHILIPS GLOEILAMPENFABRIEKEN N.V., EINDHOVEN (NETHERLANDS).	PHONE BROCH COURSELOR (PRANCE)	SOUTH DAKOTA STATE UNIV., BROOKINGS.
FORSCHUNGSLABORATORIUM.	RHONE-PROGIL, COURBEVOIE (FRANCE). (ASSIGNEE).	DEPT. OF PLANT SCIENCE.
Rapid Photochemical Decomposition of Or-	Purification of Waste Water Containing Phthal-	Water Movement Within the Root Zone of Ir-
ganic Mercury Compounds in Natural Water,	ic Esters,	rigated and Nonirrigated Grain Sorghum,
W76-05715 5A	W76-05982 5D	W76-05994 2G

SOUTHAMPTON UNIV. (ENGLAND). DEPT. OF	TEA RESEARCH INST. OF EAST AFRICA,	TEXAS A AND M UNIV., COLLEGE STATION.
OCEANOGRAPHY.	KERICHO (KENYA).	DEPT. OF RANGE SCIENCE.
Molybdenum in a Nearshore and Estuarine En- vironment, North Wales.	Irrigating Seedling Tea in Southern Tanzania: Effects on Total Yields, Distribution of Yield	Factors Influencing Infiltration and Sediment Production of Semiarid Rangelands in Nevada,
W76-06000 2K	and Water Use.	W76-05912 2G
W/0-00000	W76-05928 2I	
SOUTHERN ILLINOIS UNIV., CARBONDALE.		TEXAS A AND M UNIV., COLLEGE STATION.
DEPT. OF GEOGRAPHY.	TECHNICAL UNIV., LODZ (POLAND).	DEPT. OF SOCIOLOGY AND
Coping with Flood Hazard in New Braunfels	Use of Ion Exchangers and Synthetic Sorbents	ANTHROPOLOGY.
and Seguin, Texas,	for Removal of Color from Kraft Process ef-	Sociological Analysis of Dam Impact: A Study
W76-05502 6F	fluents (Proby zastosowania jonitow i sor-	of Twenty-Two Large Dams in Texas, W76-05501 6B
SOUTHWEST TEXAS STATE UNIV., SAN	bentow syntetycznych do usuwania barwy ze	W 70-03301
MARCOS. DEPT. OF BIOLOGY.	sciekow posiarczanosych),	TEXAS A AND M UNIV., COLLEGE STATION.
The Influence of Dissolved Oxygen Concentra-	W76-05698 5D	DEPT. OF WILDLIFE AND FISHERIES
tions on Three Species on Water Mites	TECHNICAL UNIV. OF WARSAW (POLAND).	SCIENCES.
(Hydracarina).	INST. OF ENVIRONMENTAL ENGINEERING.	The Impact of Canyon Dam and Reservoir on
W76-06133 5C	A Case Study Report on the Vistula River	Wildlife, W76-05504 6G
	Basin,	W 76-03304
STATE UNIV. COLL., AT BROCKPORT, N.Y.	W76-05514 4A	TEXAS AGRICULTURAL EXPERIMENT
DEPT. OF BIOLOGICAL SCIENCE.	The Oct Of Wiles All 1999 - 1 Company	STATION, COLLEGE STATION. DEPT. OF
The Effect of Oxidized Material on the Vertical	The Out-Of-Kilter Algorithm and Some of its	RECREATION AND PARKS.
Distribution of Freshwater Benthic Fauna,	Applications in Water Resources, W76-05515 6A	An Evaluation of Some Recreational, Demo-
W76-05743 5C	W76-05515 6A	graphic and Economic Impacts of Canyon
STATE UNIV. OF NEW YORK, ALBANY.	TECHNION-ISRAEL INST. OF TECH., HAIFA.	Lake,
DEPT. OF ATMOSPHERIC SCIENCES.	DEPT. OF CIVIL ENGINEERING.	W76-05506 6B
Detachment of Pendant Water Drops by High	Forecasting Water Levels in Aquifers by Nu-	TEXAS TECH UNIV., LUBBOCK. DEPT. OF
Voltage Pulses.	merical and Semihybrid Methods,	GEOGRAPHY.
W76-05917 2B	W76-05686 2F	Institutional Constraints and Conjunctive
		Management of Water Resources in West
STERLING DRUG, INC., NEW YORK.	TECHNISCHE UNIVERSITAET, DARMSTADT	Texas,
(ASSIGNEE).	(WEST GERMANY). WASSER- UND	W76-05842 6E
Wastewater Treatment,	ABWASSERFORSCHUNGSSTELLE.	MONTH AND ANGENIN DEDE OF
W76-05961 / 5D	Effluent Discharge Law-Burdens and Con-	TEXAS UNIV. AT AUSTIN. DEPT. OF
	sequences for the Paper Industry (Abwasserabgabengesetz-Belastungen und Fol-	PETROLEUM ENGINEERING. Development and Field Testing of a Basin
Filter Cleaning Method,	gerungen fuer die Papierindustrie),	Hydrology Simulator,
W76-05974 5F	W76-05712 5G	W76-05745 2A
STOCKHOLM UNIV. (SWEDEN), DEPT. OF	W10-05/12	W 70-03743
GEOLOGY.	TENCO HYDRO/AEROSCIENCES, INC.,	TEXAS UNIV. AT DALLAS, RICHARDSON.
Vyredox-In Situ Purification of Ground Water,	COUNTRYSIDE, ILL. (ASSIGNEE).	Studies on the Ca, Mg, and Sr Content of
W76-05553 5F	Dissolved Air Floatation System,	Freshwater Clamshells,
W 70-03333	W76-05976 5D	W76-06119 2H
SUMITOMO JUKIKAI ENVIROTECH, INC.		THAMES WATER AUTHORITY, LONDON
(JAPAN).	TENNESSEE UNIV., KNOXVILLE. CENTER	(ENGLAND).
Activated Carbon Treatment of Pulp and Paper	FOR BUSINESS AND ECONOMIC RESEARCH. Measuring and Minimizing the Social Cost of	Financing the New Water Authorities,
Waste Water,	Environmental Pollution,	W76-05810 6C
W76-05730 5D	W76-05824 5G	
	W 70-03024	THAMES WATER AUTHORITY, READING
SUNNITTELUKĘSKUS-MKR, HELSINKI	TENNESSEE UNIV., KNOXVILLE. DEPT. OF	(ENGLAND). OPERATIONAL RESEARCH
(FINLAND).	CHEMISTRY.	UNIT.
Examination and Removal of Iron in Ground-	Determination of Selenium in Natural Waters	Real-Time Management of Water-Resource Systems.
water, W76-05571 5B	Using the Centrifugal Photometric Analyzer,	W76-05747 6A
W /6-033/1 3B	W76-06128 2K	W 70-03/47
SWEDISH CELLULOSE CO., SUNDSVALL.	TENNESSEE UNIV., KNOXVILLE. DEPT. OF	TORAY INDUSTRIES, INC., TOKYO (JAPAN).
Water Pollution in Connection with Bark	CIVIL ENGINEERING.	(ASSIGNEE).
Dumping (Vattenfororeningar i samband med	Impact of Coal Strip Mining on Water Quality	Reverse Osmosis Separation Apparatus,
barkdeponering),	and Hydrology of East Tennessee,	W76-05990 3A
W76-05726 5B	W76-05833 5B	TOUPS CORP., SANTA ANA, CALIF.
		Water Factory 21 is the Future,
SWEDISH FOREST PRODUCTS RESEARCH	TENNESSEE VALLEY AUTHORITY,	W76-05782 5F
LAB., STOCKHOLM.	KNOXVILLE. FLOOD CONTROL BRANCH.	
Chemical Characterization of Fiber Building	Monetary Values of Life and Health.	TRENT UNIV., PETERBOROUGH (ONTARIO).
Board Mill Effluent,	W76-05812 6F	DEPT. OF BIOLOGY.
W76-05731 5A	TEXACO INC., NEW YORK. (ASSIGNEE).	Development of Oxygen Deficits in 14
SWEDISH WATER AND AIR POLLUTION	Emulsion Breaking Method,	Southern Ontario Lakes,
RESEARCH LAB., GOTEBORG.	W76-05527 5G	W76-05679 5C
Spatial Dispersion of an Estuarine Benthic Fau-		TSENTRAL'NII NAUCHNO-
nal Community,	TEXAS A AND M UNIV., COLLEGE STATION.	ISSLEDOVATEL'SKII I PROEKTNII INSTITUT
W76-06040 2L	DEPT. OF GEOGRAPHY; AND TEXAS A AND	LESOKHIMICHESKOI PROMYSHLENNOSTI,
CHENTEL STATE AND ADDRESS OF THE PARTY OF TH	M UNIV., COLLEGE STATION. DEPT. OF	KHIMKI (USSR).
SYDNEY UNIV. (AUSTRALIA). DEPT. OF	GEOLOGY.	Rapid Determination of the Cod of Effluents
ACCOUNTING.	Some Economic and Decision Aspects of the	(Uskorennoe opredelenie KhPK stochnykh
Costs as a Guide to Pricing,	Canyon Project, W76-05505 6B	vod), W76-05705 5A
W76-05570 6C	W76-05505 6B	W76-05705 5A

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TSENTRAL'NII NAUCHNO-	UNIVERSITY OF WESTERN ONTARIO,	VIRGINIA UNIV., CHARLOTTESVILLE. DEPT.
ISSLEDOVATEL'SKII I PROEKTNII INSTITUT	LONDON. DEPT. OF GEOGRAPHY.	OF BIOLOGY.
LESOKHIMICHESKOI PROMYSHLENNOSTI,	Urban Water Management of an International	Microbiological and Chemical Enrichment of
KHIMKI (USSR9. Purification of Gum Rosin Producing Plant Ef-	River: The Case of El Paso -Juarez, W76-05661 3D	Freshwater-Surface Microlayers Relative to the
fluents from Resinous Substances (Ochistka	W76-05661 3D	Bulk-Subsurface Water, W76-06124 5C
stochnykh vod kanifol'noterpentinnogo proiz-	International Management of the River Plate	W 70-00124
vodstva ot smolistykh veshchestv),	Basin,	VSESOYUZNYI NAUCHNII PLANOVII OTDEL
W76-05735 5D	W76-05756 4A	BUMAZHNOI PROMYSHLENNOSTI MOSCOW
UKRAINSKII NAUCHNO-ISSLEDOVATELSI	TITLE BY ANNING COMMISSION CALLS AND	(USSR).
GIDROMETEOROLOGICHESKI INST.(USSR).	UTAH PLANNING COMMISSION, SALT LAKE CITY.	Reduction of Effluent Volume and Fresh Water
Allowance for Precipitation and Runoff Fluc-	Utah's Third Year of Planning for the Four	Consumption (Snizhenie ob'ema ctochnykh
tuation Patterns in Computing Water	Corners Regional Commission,	vod i raskhoda svezhej vody), W76-05727 3E
Withdrawal for Irrigation Systems in the	W76-05827 6B	W76-05727 3E
Southern Ukraine,		VSESOYUZNYI NAUCHNO-
W76-05675 4A	UTAH STATE DIV. OF HEALTH, SALT LAKE	ISSLEDOVATELSKII INSTITUT
UNIFLEX S.P.A., (ITALY). (ASSIGNEE).	CITY, BUREAU OF LABORATORIES.	LESOVODSTVA I MEKHANIZATSII LESNOGO
Water Line,	An Automated Technique for the Sub-Micro-	KHOZYAISTVA, PUSHKINO (USSR).
W76-05541 3F	gram Determination of Selenium and Arsenic in	Snow Accumulation and Melting in the Forest
INITED NATIONS PRICATIONAL	Surface Waters by Atomic Absorption Spec-	and in Clear-Cut Areas in the Central Ural,
UNITED NATIONS EDUCATIONAL, SCIENTIFIC, AND CULTURAL	troscopy, W76-05736 5A	W76-05929 2C
ORGANIZATION, PARIS (FRANCE).		WIN INC. ORI ANDO DI
Distribution and Structure of Benthic Assem-	UTAH STATE UNIV., LOGAN.	VTN, INC., ORLANDO, FLA.
blages in Puget Sound, Washington, USA,	Biomass Distribution and Kinetics of Baffled	Effective Use of High Water Table Areas for
W76-06015 5B	Lagoons,	Sanitary Landfill. Vol. II, W76-05744 5G
UNIV PARACHI PARACHI RAV DER	W76-05590 5D	W 76-03744
UNIV. KARACHI, KARACHI, PAK. DEP. ZOOL., KARACHI UNIV. (PAKISTAN). DEPT.	HTAH CTATE UNIV LOCAN DEBT OF CIVIL	VYZKUMNY USTAV CHEMICKYCH
OF ZOOLOGY.	UTAH STATE UNIV., LOGAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.	ZARIZENI, BRNO (CZECHOSLOVAKIA).
Seasonal Distribution of Phytoplankton in Kinj-	Structuring Communications Programs for	Study of Turbine Mixers for Flow-Through
har (Kalri) Lake.	Public Participation in Water Resources	Flocculation Chambers (Vyzkum turbinovych
W76-06146 5C	Planning,	michadel pro prutocne flokulacni komory),
	W76-05652 6B	W76-05703 5D
UNIV. WIS., MADISON, WISCONSIN UNIV.,		
MADISON. Lake Wingra, 1837-1973: A Case History of	VICTORIA UNIV. (BRITISH COLUMBIA).	WASHINGTON UNIV., SEATTLE.
Human Impact,	DEPT. OF GEOGRAPHY.	Systems Approach to River Basin and Inter-
W76-05997 5C	Flood Loss Management in Developing Coun-	basin Development,
	tries: A Model for Identifying Appropriate	W76-05512 4A
UNIVERSAL OIL PRODUCTS CO., DENVER,	Strategies,	WACHINGTON HAIV SEATTLE
COLO. JOHNSON DIV.	W76-05761 6A	WASHINGTON UNIV., SEATTLE. GEOPHYSICS PROGRAM.
Air Rotary Drilling with Organic Polymers Of- fers Many Benefits,	VICTORIA UNIV. OF MANCHESTER	Some Observations on the Behavior of the
W76-05562 8B	(ENGLAND). DEPT. OF ZOOLOGY.	Liquid and Gas Phases in Temperate Glacier
W 70-03302	Selector Systems in Recording Physiological	Ice.
UNIVERSAL OIL PRODUCTS CO., DES	and Behavioral Activity in Sedentary Aquatic	W76-05915 2C
PLAINES, ILL. (ASSIGNEE).	Animals,	
Portable Water Sampling Apparatus,	W76-06039 2I	WATER MANAGEMENT CENTER, BUDAPEST
W76-05958 7B	VICTORIA UNIV. OF MANCHESTER	(HUNGARY). DEPT. OF LONG RANGE
UNIVERSAL OIL PRODUCTS, ST. PAUL,		PLANNING.
MINN. JOHNSON DIV.	(ENGLAND). POLLUTION RESEARCH UNIT. A Note on the Use of Algal Sizes in Estimates	Water Resources Development in the Tisza
Siphon System Yields Chilean Plant More	of Population Standing Crops,	River Basin and Its Impact on Socio-Economic
Water,	W76-06043 5A	Growth,
W76-05550 8C	, , ,	W76-05519 4A
Careful Sample Taking is Key to Successful	VIRGINIA INST. OF MARINE SCIENCE,	WATER PURIFICATION ASSOCIATES,
Wells,	GLOUCESTER POINT.	CAMBRIDGE, MASS. (ASSIGNEE).
W76-05560 4B	Epizootiology of Minchinia Nelsoni in	Detection Devices for Use in Solution
	Susceptible Wild Oysters in Virginia, 1959 To	Processing Systems,
A Driller's Good Friend - The Electric Logger,	1971,	W76-05532 5F
W76-05561 8G	W76-06035 5C	
Efficient Wells Save Energy and Reduce Costs,	VIRGINIA POLYTECHNIC INST. AND STATE	WATER RESEARCH CENTRE, MEDMENHAM
W76-05563 4B	UNIV., BLACKSBURG. DEPT. OF BIOLOGY.	(ENGLAND). MEDMENHAM LAB.
II	Eutrophic Gradient in Smith Mountain Lake,	Nitrate Removal from Water by Ion Exchange,
Use of Formation Stabilizer - A Valuable	Virginia,	W76-05806 5F
Technique, W76-05564 8A	W76-05627 5C	WATER RESOURCES CENTER, BUDAPEST
W 70-03304 8A		
Proper Selection of Gravel Pack is Key to Suc-	Assessment of a Stressed Macroinvertebrate	(HUNGARY). Uncertainty in Water Resources Decision Mak-
cessful Wells,	Community,	· · · · · · · · · · · · · · · · · · ·
W76-05565 8C	W76-05636 5C	ing, W76-05513 6A
UNIVERSIDAD NACIONAL AUTONOMA DE	VIRGINIA POLYTECHNIC INST. AND STATE	W. 10 05515
MEXICO, MEXICO CITY. CENTRO DE	UNIV., BLACKSBURG. DEPT. OF CIVIL	WATERLOO UNIV. (ONTARIO). DEPT. OF
RELACIONES INTERNACIONALES.	ENGINEERING.	EARTH SCIENCES.
Principal Economic Aspects of the Problem of	Modeling the Effect of Waste Discharges in a	Finite Element Mesh Gradation for Surface
Salinity of the Colorado River,	Small Mountain Stream,	Waves,
W74 05921	W76 05024 5D	W74 05010 PE

WATERLOO UNIV. (ONTARIO). DEPT. OF	WOODS HOLE OCEANOGRAPHIC
MAN-ENVIRONMENT STUDIES.	INSTITUTION, MASS.
Willingness to Pay as a Behaviourial Criterion for Environmental Decision-Making,	
W76-05826 5G	Temperature Elevation, W76-05999 5C
Environmental Impact Assessment as an In-	WORLD HEALTH ORGANIZATION, DAR ES
strument of Public Policy for Controlling	SALAAM (TANZANIA). EAST AFRICAN AEDES
Economic Growth,	RESEARCH UNIT.
W76-05828 6G	Breeding Places and Seasonal Incidence of
	Aedes Aegypti, as Assessed by the Single-
WENDELL ASSOCIATES, MCLEAN, VA.	Larva Survey Method,
A Study of Prospective Water Pollution Con-	W76-06033 5G
trol Activities for the Ohio River Valley Water	WORLD METEOROLOGICAL
Sanitation Commission (Orsanco), W76-05654 5G	WORLD METEOROLOGICAL
W 70-03034	ORGANIZATION, GENEVA (SWITZERLAND).
WESLEYAN COLL., MACON, GA. DEPT. OF	River Basin Models and Their Application with Scarcity of Data.
BUSINESS ADMINISTRATION.	W76-05516 4A
A Portfolio Approach to Public Water Project	
Decision Making,	A Review of Some Hydrological Studies
W76-05995 6B	Required in the Design of Water Management
WEST PAKISTAN WATER AND POWER	Projects.
DEVELOPMENT AUTHORITY, LAHORE.	W76-05517 4A
Inter Basin Transfer of Water Resource Case	Banefit and Cast Analysis of Wedgelesian
Study of Indus Project,	Benefit and Cost Analysis of Hydrological Forecasts.
W76-05753 4A	W76-05823 6B
WEST VIRGINIA UNIV., MORGANTOWN.	WRIGHT WATER ENGINEERS, INC.,
Fecundity of the Brown Bullhead, Ictalurus	DENVER, COLO.
Nebulosus (Le Sueur) in a Mine Acid Polluted	Colorado City Solves its Sand Pumping
River,	Problems,
W76-05641 8I	W76-05559 8C
WHITMAN AND HOWARD, INC., BOSTON,	YAMATAKE-HONEYWELL CO., LTD., TOKYO
MASS.	(JAPAN). (ASSIGNEE).
Combined Waste Treatment Proves Economi-	Flowmeter for an Open Aqueduct,
cal and Feasible,	W76-05540 7B
W76-05787 5D	
	YORK COLL., PA.
WILLIAM AND WORKS, GRAND RAPIDS,	An Ichthyofaunal Survey and Discussion of
MICH.	Fish Species Diversity as an Indicator of Water
Pond and Irrigation Systems Offer Economy	Quality, Codorus Creek Drainage, York Coun-
and Flexibility,	ty, Pennsylvania,
W76-05774 5D	W76-05634 5A
WILLIAMS AND WORKS, GRAND RAPIDS,	ZAGREB UNIV. (YUGOSLAVIA).
MICH.	Extraction - Visible Spectrophotometric
Plastic Pipe, Pressure Sewers, Mark Expan-	Method for Determination of Nitrate: Applica-
sion,	tion to Water Analysis,
W76-05765 5D	W76-05717 5A
Design, Operation, and Monitoring of Mu-	ZEOPLANT CO. LTD., OSAKA (JAPAN).
nicipal Irrigation Systems,	(ASSIGNEE).
W76-05783 5E	Desalination Apparatus,
WINDSOD UNIV (ONTARIO) DERT OF CIVIL	W76-05959 3A
WINDSOR UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.	
Quality and Variation of Pollutant Loads in	
Urban Stormwater Runoff,	
W76-05576 5B	
3B	
A Stable Numerical Model for Local Scour,	
W76-05666 2J	
WIGGONON VINEY ALLESSES	
WISCONSIN UNIV., MADISON.	
Antimycin: Beyond Teleocide,	
W76-05662 5C	
Temperature Optimum of Algae Living in the	
Outfall of a Power Plant on Lake Monona.	
W76-06001 5C	
30	
WISCONSIN UNIV., MADISON. DEPT. OF	
AGRONOMY.	
Plant Development Under Snow,	
W76-06147 21	

D

r-A

he

C T

za nic 4A

on 5F M ge, 5F

lak-6A

face 8E

ACCESSION NUMBER INDEX

W76-05501	6B	W76-05579	5D	5	W76-05657	6D	e e	W76-05735	5D
W76-05502	6F	W76-05580	5D	<i>p</i> -	W76-05658	5G	*	W76-05736	5A
W76-05503	2H	W76-05581	5D		W76-05659	5G		W76-05737	
									5D
W76-05504	6G	W76-05582	5D		W76-05660	4A		W76-05738	5D
W76-05505	6B	W76-05583	5D		W76-05661	3D		W76-05739	6D
W76-05506	6B	W76-05584	5D						
					W76-05662	5C		W76-05740	5C
W76-05507	5B	W76-05585	5D		W76-05663	23		W76-05741	5C
W76-05508	4A	W76-05586	5D		W76-05664	2C		W76-05742	5C
W76-05509	5D	W76-05587	5D		W76-05665	2B		W76-05743	5C
W76-05510	4A	W76-05588	5D		W76-05666	2J		W76-05744	5G
W76-05511	4A								
		W76-05589	5D		W76-05667	8D		W76-05745	2A
W76-05512	4A	W76-05590	5D		W76-05668	4A		W76-05746	4A
W76-05513	6A	W76-05591	5D		W76-05669	2C		W76-05747	6A
W76-05514	4A	W76-05592	5D		W76-05670	2G		W76-05748	6A
W76-05515	6A	W76-05593	5D		W76-05671	2C		W76-05749	6A
W76-05516	4A								
		W76-05594	5A		W76-05672	2C		W76-05750	4A
W76-05517	4A	W76-05595	5C		W76-05673	2C		W76-05751	6A
W76-05518	5G	W76-05596	5A		W76-05674	7B		W76-05752	6A
W76-05519	4A	W76-05597	5D		W76-05675	4A		W76-05753	4A
W76-05520	4A	W76-05598	5D		W76-05676	4A		W76-05754	4A
W76-05521	4A	W76-05599	5G						
					W76-05677	3B		W76-05755	6A
W76-05522	6A	W76-05600	4B		W76-05678	5B		W76-05756	4A
W76-05523	8A	W76-05601	5B		W76-05679	5C		W76-05757	6A
W76-05524	5D	W76-05602	5D		W76-05680	7B		W76-05758	6E
W76-05525	5D	W76-05603	2B		W76-05681	2C		W76-05759	6E
W76-05526	3A	W76-05604	5C						
					W76-05682	2C		W76-05760	6A
W76-05527	5G	W76-05605	5B		W76-J5683	2C		W76-05761	6A
W76-05528	5D	W76-05606	5B		W76-05684	2F			6A
								W76-05762	
W76-05529	5D	W76-05607	6D		W76-05685	2F		W76-05763	4A
W76-05530	5F	W76-05608	5B		W76-05686	2F		W76-05764	5D
W76-05531	5F	W76-05609	5D		W76-05687	21		W76-05765	5D
W76-05532	5F	W76-05610	5D		W76-05688	2F		W76-05766	5D
W76-05533	5G								
		W76-05611	6B		W76-05689	2F		W76-05767	5D
W76-05534	5G	W76-05612	5C		W76-05690	2J		W76-05768	5D
W76-05535	5D	W76-05613	7B		W76-05691	2B		W76-05769	5D
W76-05536	5D	W76-05614	4C		W76-05692	2B		W76-05770	5D
W76-05537	8C	W76-05615	5A		W76-05693	2B		W76-05771	5D
W76-05538	8C	W76-05616	5B		W76-05694	2B		W76-05772	5D
W76-05539	7B	W76-05617	4D		W76-05695	2C		W76-05773	5D
W76-05540	7B	W76-05618	5B		W76-05696	5C		W76-05774	5D
W76-05541	3F	W76-05619	5B		W76-05697	5D		W76-05775	5D
W76-05542	5D	W76-05620	4D		W76-05698	5D		W76-05776	5D
W76-05543	5D	W76-05621	4D		W76-05699	5D		W76-05777	5D
W76-05544	5F	W76-05622	5A		W76-05700	5D		W76-05778	5D
W76-05545	5D	W76-05623	5C						
					W76-05701	5B		W76-05779	5F
W76-05546	5D	W76-05624	5B		W76-05702	5D		W76-05780	5F
W76-05547	5F	W76-05625	5C		W76-05703	5D		W76-05781	5D
W76-05548	5G	W76-05626	5C		W76-05704	5D		W76-05782	5F
W76-05549	8C	W76-05627	5C		W76-05705	5A		W76-05783	5E
W76-05550	8C	W76-05628	5C						
					W76-05706	5D		W76-05784	5D
W76-05551	2F	W76-05629	5C		W76-05707	5D		W76-05785	5D
W76-05552	8G	W76-05630	5C		W76-05708	5D		W76-05786	5D
W76-05553	5F	W76-05631	5C		W76-05709	5A		W76-05787	5D
W76-05554	2F	W76-05632	5B		W76-05710	5C		W76-05788	5D
W76-05555	8G	W76-05633	5C		W76-05711	5D		W76-05789	5D
W76-05556	4B	W76-05634	5A		W76-05712	5G		W76-05790	5D
W76-05557	6A	W76-05635	5C		W76-05713	5D		W76-05791	5E
W76-05558	4B	W76-05636	5C		W76-05714	5G		W76-05792	5D
W76-05559	8C	W76-05637	5C		W76-05715	5A		W76-05793	5D
W76-05560	4B	W76-05638	5C		W76-05716	5A		W76-05794	5D
W76-05561	8G	W76-05639	5C		W76-05717	5A		W76-05795	5D
W76-05562	8B	W76-05640	5C		W76-05718	5D		W76-05796	5D
W76-05563	4B	W76-05641	81		W76-05719	5D		W76-05797	5D
W76-05564	8A	W76-05642	5C		W76-05720	5B		W76-05798	5D
W76-05565	8C	W76-05643	4A		W76-05721	5D		W76-05799	5D
W76-05566	4B	W76-05644	4A		W76-05722	5G		W76-05800	5D
W76-05567	4B	W76-05645	4A		W76-05723	5D		W76-05801	5D
W76-05568	8A	W76-05646	4.4		W76-05724	5D		W76-05802	5D
W76-05569	8G	W76-05647	4A		W76-05725	5E		W76-05803	5D
W76-05570	6C	W76-05648	4A		W76-05726	5B		W76-05804	5D
W76-05571	470								
	5B	W76-05649	6G		W76-05727	3E		W76-05805	5D
W76-05572	8C	W76-05650	6G		W76-05728	5A		W76-05806	5F
W76-05573	5B	W76-05651	6B		W76-05729	5E		W76-05807	5D
W76-05574	8C	W76-05652	6B		W76-05730	5D		W76-05808	5F
W76-05575	5D	W76-05653	6B		W76-05731	5A		W76-05809	5D
W76-05576	5B	W76-05654	40		W76-05732	5D			6C
								W76-05810	
W76-05577	2A	W76-05655	6C		W76-05733	5G		W76-05811	3A
W76-05578	5F	W76-05656	5G		W76-05734	5B		W76-05812	6F
						-			

ACCESSION NUMBER INDEX

W76-05813

W76-05813							
W76-05813	5G	W76-05892	5B	W76-05971	3A	W76-06050	6D
W76-05813	5D	W76-05893	5C	W76-05972	5D	W76-06051	4A
W76-05815	6D	W76-05894	5C	W76-05973	5D	W76-06052	4A
W76-05816	6E	W76-05895	5C	W76-05974	5F	W76-06053	6E
W76-05817	5G	W76-05896	5C	W76-05975	5F	W76-06054	6E
W76-05818	5G	W76-05897	SC SC	W76-05976	5D	W76-06055 W76-06056	6E 5G
W76-05819	4A	W76-05898	SC SC	W76-05977 W76-05978	7B 3A	W76-06057	6E
W76-05820 W76-05821	6B 6E	W76-05899 W76-05900	5C	W76-05979	3A	W76-06058	6E
W76-05821	6B	W76-05901	5C	W76-05980	3A	W76-06059	6F
W76-05823	6B	W76-05902	5C	W76-05981	5D	W76-06060	6F
W76-05824	5G	W76-05903	5C	W76-05982	5D	W76-06061	5G
W76-05825	5G	W76-05904	5B	W76-05983	5F	W76-06062	5G
W76-05826	5G	W76-05905	5B	W76-05984	5G	W76-06063	5G
W76-05827	6B	W76-05906	5G	W76-05985	5D 5D	W76-06064 W76-06065	5D 5G
W76-05828	6G	W76-05907	5G 4A	W76-05986	5D	W76-06066	5G
W76-05829 W76-05830	6B 5D	W76-05908 W76-05909	2A .	W76-05988	5D	W76-06067	5G
W76-05831	5D	W76-05910	2E	W76-05989	5F	W76-06068	5G
W76-05832	5F	W76-05911	2E	W76-05990	3A	W76-06069	5G
W76-05833	5B	W76-05912	2G	W76-05991	3A	W76-06070	5G
W76-05834	5B	W76-05913	4B	W76-05992	5G	W76-06071	5G
W76-05835	4B	W76-05914	4B	W76-05993	6B	W76-06072	5G
W76-05836	5B	W76-05915	2C	W76-05994	2G	W76-06073	5G
W76-05837	6B	W76-05916	2C	W76-05995	6B 2K	W76-06074 W76-06075	5G 5G
W76-05838	5A	W76-05917 W76-05918	2B 8B	W76-05996 W76-05997	5C	W76-06076	5G
W76-05839 W76-05840	5D 6B	W76-05919	8E	W76-05998	5A	W76-06077	5G
W76-05841	5B	W76-05920	8B	W76-05999	5C	W76-06078	5G
W76-05842	6E	W76-05921	2E	W76-06000	2K	W76-06079	5G
W76-05843	2D	W76-05922	5A	W76-06001	5C	W76-06080	6E
W76-05844	2J	W76-05923	4A	W76-06002	21	W76-06081	6E
W76-05845	2L	W76-05924	8B	W76-06003	2G	W76-06082	5D
W76-05846	6A	W76-05925	4C	W76-06004	5C	W76-06083	4A
W76-05847	2F	W76-05926	5B	W76-06005	21	W76-06084	5G
W76-05848	7C	W76-05927	4C	W76-06006	2B	W76-06085 W76-06086	5G 5G
W76-05849	2J	W76-05928	21	W76-06007	5A	W76-06087	6E
W76-05850	21	W76-05929	2C 3B	W76-06008 W76-06009	5A 5A	W76-06088	6E
W76-05851 W76-05852	2F 7C	W76-05930 W76-05931	2E	W76-06010	SC SC	W76-06089	6E
W76-05853	7C	W76-05932	8B	W76-06011	5G	W76-06090	6E
W76-05854	4C	W76-05933	2B	W76-06012	5C	W76-06091	6E
W76-05855	5B	W76-05934	2A	W76-06013	21	W76-06092	6E
W76-05856	4B	W76-05935	2G	W76-06014	21	W76-06093	6E
W76-05857	7C	W76-05936	4C	W76-06015	5B	W76-06094	6E
W76-05858	7C	W76-05937	4D	W76-06016	3F	W76-06095	6E
W76-05859	7C	W76-05938	5B	W76-06017	3F	W76-06096	5G
W76-05860	2E	W76-05939	4C	W76-06018	2H 5B	W76-06097 W76-06098	5G 5G
W76-05861 W76-05862	2F 7C	W76-05940 W76-05941	5C 4D	W76-06019 W76-06020	5C	W76-06099	6E
W76-05863	5C	W76-05942	5B	W76-06021	21	W76-06100	6E
W76-05864	5D	W76-05943	5B	W76-06022	2L	W76-06101	6E
W76-05865	5D	W76-05944	4C	W76-06023	2L	W76-06102	6E
W76-05866	5G	W76-05945	5B	W76-06024	5A	W76-06103	6E
W76-05867	5D	W76-05946	5B	W76-06025	2H	W76-06104	6E
W76-05868	5D	W76-05947	4D	W76-06026	21	W76-06105	6E
W76-05869	5A	W76-05948	4C	W76-06027	4A	W76-06106	6E
W76-05870	5C	W76-05949	5B	W76-06028	5A	W76-06107 W76-06108	6E 6E
W76-05871	5C 5C	W76-05950 W76-05951	4D 5G	W76-06029 W76-06030	2D 3C	W76-06109	6E
W76-05872 W76-05873	5C	W76-05952	10D	W76-06031	5C	W76-06110	6E
W76-05874	5C	W76-05953	2H	W76-06032	3F	W76-06111	6E
W76-05875	5C	W76-05954	5A	W76-06033	5G	W76-06112	6E
W76-05876	SC	W76-05955	5D	W76-06034	5C	W76-06113	6E
W76-05877	5C	W76-05956	3F	W76-06035	5C	W76-06114	6E
W76-05878	5C	W76-05957	3F	W76-06036		W76-06115	6E
W76-05879	5C	W76-05958	7B	W76-06037	2D	W76-06116	2G
W76-05880	5C	W76-05959	3A	W76-06038	2G	W76-06117	2H
W76-05881	5C	W76-05960	5D 5D	W76-06039 W76-06040	2I 2L	W76-06118 W76-06119	2H 2H
W76-05882 W76-05883	5C 5C	W76-05961 W76-05962	5D	W76-06040	2B	W76-06120	2H
W76-05884	5B	W76-05963	5D	W76-06041		W76-06121	5C
W76-05885	5B	W76-05964	5D	W76-06043	5A	W76-06122	5A
W76-05886		W76-05965	5D	W76-06044		W76-06123	2D
W76-05887	5B	W76-05966	5D	W76-06045		W76-06124	5C
W76-05888	5C	W76-05967	5D	W76-06046		W76-06125	5B
W76-05889		W76-05968	5F	W76-06047		W76-06126	
W76-05890		W76-05969		W76-06048		W76-06127 W76-06128	
W76-05891	5B	W76-05970	5G	W76-06049	3A	W /U-00128	2R

W76-06129 2I
W76-06130 2I
W76-06131 2L
W76-06132 2H
W76-06133 5C
W76-06134 2L
W76-06136 5A
W76-06137 5B
W76-06138 5C
W76-06139 5B
W76-06140 2J
W76-06141 2G
W76-06142 5C
W76-06143 2H
W76-06144 5C
W76-06145 8I
W76-06145 5C
W76-06145 5C
W76-06148 5C
W76-06148 5C
W76-06148 5C
W76-06149 5G
W76-06149 5G

1

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ABSTRACT SOURCES

OURCE	ACCESSION NUMBER	TOTAL
. CENTERS OF COMPETENCE		
Cornell University, Policy Models for Water Resources Systems	W76-0550705522 0574605763 05995	35
ERDA Oak Ridge National Laboratory, Nuclear Radiation and Safety	W76-0587005903	34
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W76-0557505594 0559605600 0560905610 0576405809 0583105832	75
Illinois State Water Survey, Hydrology	W76-05608 0566305686 0568805695 05745 0590405927 0592905934 05994	65
Institute of Paper Chemistry, Water Pollution from Pulp and Paper Industry	W76-0569605739	44
National Water Well Association, Water Well Construction Technology	W76-0555005574	25
University of Florida, Eastern U. S. Water Law	W76-0605006115	66
University of North Carolina, Metropolitan Water Resources Planning and Management	W76-0564305661	19
University of Wisconsin, Eutrophication	W76-0562205631 0563305642	20

ABSTRACT SOURCES

SOURCE		ACCESSION NUMBER	TOTAL
Α.	CENTERS OF COMPETENCE (CONTINUED)		
	University of Wisconsin, Water Resources Economics	W76-0550105506 05611 0581005829 05951	28
В.	STATE WATER RESOURCES RESEARCH INSTITUTES	W76-0560105607	7
C.	OTHER		
	BioSciences Information Service	W76-05595, 05632 05662, 05687 05928 05952 0 5954 0599606048 0611606150	96
	Bureau of Reclamation	W76-05993	1
	Effects of Pollutants on Aquatic Life (Katz)	W76-0574005743	4
	Environmental Protection Agency	W76-0586305869	7
	Forest Service (USDA)	W76-0561205621 0593505950	26
	Ocean Engineering Information Service (Patents)	W76-0552305549 0595505992	65
	Office of Water Research and Technology	W76-0583305842 06049	11
	U. S. Geological Survey	W76-0584305862	20

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